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JOHN E. OWENS, M. D.,

CHICAGO, ILL.

Second President American Academy of Railway Surgeons:
Chief Surgeon Illinois Central Railway.

THE AMERICAN ACADEMY OF RAILWAY SURGEONS.

Report of the Third Annual Meeting

LANE LIBRARY

HELD AT

CHICAGO, ILL., SEPT. 23, 24 AND 25, 1896.

EDITED BY

R. HARVEY REED, M.D.

COLUMBUS, OHIO.

LANE MEDICAL LIBRARY
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AMERICAN MEDICAL ASSOCIATION PRESS.
1897.

THE HIGHER THE ORDER OF RAILWAY SURGERY THE GREATER THE PROTECTION TO THE EMPLOYE, THE PASSENGER AND THE COMPANY.

PREFACE.

With the rapid advancement of the medical and surgical sciences new developments and discoveries have created a demand for new departments. It is only a few years since the birth of bacteriology, the regeneration of pathology and the advent of asepsis and antisepsis. It is scarcely a decade since the rejuvenating of Military Surgery and the evolution of its twin sister, Railway Surgery. Each year brings them into a higher state of development and with each year's experience it has been demonstrated that "The higher the order of railway surgery, the greater the protection to the employé, the passenger and the company."

With the Third Annual Report of the Transactions of the American Academy of Railway Surgeons, the Editor has the pleasure of presenting its Fellows with over fifty pages more of reading matter than was contained in the last volume and a hundred and fifty more than was contained in the previous one. For this you are indebted to the authors who contributed so liberally to the proceedings and the Fellows who partook in the various discussions.

In presenting this, the Third Annual Report, the Editor feels that his ambition is being gratified in so much, " that each succeeding volume of the Transactions has excelled its predecessor." This he attributes to the increasing experience of the Fellows of the Academy and the special pains they have taken in the

preparation and discussion of papers on practical and important subjects.

We desire to thank the officers, authors and publishers for their hearty co-operation and especially Capt. James E. Pilcher, Surgeon of the U. S. Army, for his valuable assistance in compiling this report.

R. HARVEY REED, M.D.

COLUMBUS, OHIO, August 7, 1897.

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Stamps	$ 9.30
Express and freight	7.49
Paper, envelopes	4.75
Telegrams	.50
Stenographer and clerk	42.00
Total	$64.04

In retiring from the office I would suggest that in your annual election you combine the offices of Secretary and Treasurer. There are so many things in common with these offices in an association of this character that I am sure it will save much expense in mail, paper, and clerk hire, and I would ask you to select your present Treasurer as the one who could serve you best.

In closing, I desire to publicly thank our worthy President and efficient Editor for the work done during my severe sickness. To them alone is due the credit of the magnificent program which is here to-day.

I am only too sorry that I can not be with you, but my long and severe sickness compels me to remain at home.

Very truly yours, WEBB J. KELLY.

Voted that an order be drawn for $18.04 in favor of DR. KELLY to balance his account.

TREASURER'S REPORT.

To the Fellows of the American Academy of Railway Surgeons:

The Treasurer begs to report that he has received dues and membership fees since last report as follows	$415.00
Balance on hand	64.01
Total	$479.01
Credit by cash current expenses of the Academy as per approved vouchers	$292.10
Leaving balance on hand	$196.91

Respectfully submitted,

C. B. KIBLER, Treasurer.

Approved Sept. 22, 1896:

C. M. DANIELS, MILTON JAY, M. GARDNER.

APPENDIX.

Voucher No. 1, Sept. 27, 1895, Webb J. Kelly	$ 15.00
" " 2, Sept. 27, 1895, Auditorium	7.20
" " 3, Sept. 28, 1895, Dr. J. B. Hamilton	116.00
" " 4, Sept. 28, 1895, N. F. Ames & Co	1.00
" " 5, Sept. 28, 1895, Webb J. Kelly	68.80
" " 6, Oct. 30, 1895, L. Trimble	7.00
" " 7, Oct. 30, 1895, Postage	1.00

Voucher No. 8,	Nov. 21, 1895, Express and Postage	2.35
" " 9,	Dec. 4, 1895, Postage	2.00
" " 10,	Dec. 9, 1895, Webb J. Kelly	15.00
" " 11,	Jan. 2, 1896, Postage and Express	2.00
" " 12,	Jan. 7, 1896, W. J. Morgan & Co.	36.75
" " 13,	April 10, 1896, Webb J. Kelly	15.00
" " 14,	April 10, 1896, J. A. Pain	3.00
	Total	$292.10

On motion of DR. C. K. COLE the reports from the Secretary and Treasurer were referred to the Executive Board and the recommendation for combining these offices into one was laid on the table.

The names of DRS. S. W. GRANT, SQUIRE, BROWN, I. H. GOSS, E. W. REED, D. H. COOVER, HENRY A. ARGUE and W. I. MAYO were presented, but as the same did not have the requisite number of signatures of Fellows to recommend them, the matter of new members was deferred to a later session.

DR. R. HARVEY REED presented the name of DR. JAS. E. PILCHER, U. S. A., Columbus, Ohio, to honorary Fellowship. DR. C. M. DANIELS explained that a similar motion was made last year in reference to HON. TRACY C. BECKER of Buffalo, New York. On motion of DR. W. A. WARD, the matter of the election of honorary members was referred to the Executive Board. On motion of DR. KIBLER the bills submitted by DRS. REED and KELLY, for postage, etc., were referred to the Executive Board.

DR. REED called up the questions in reference to a stenographer, and by whom the proceedings were to be published, and suggested that they should be settled early. The chairman of the publishing committee was instructed to procure a stenographer.

Executive session adjourned at this point and regular programme continued.

The first paper was presented by ROBERT MATHER, Esq., General Attorney C. R. I. & P. Ry. Co., Chicago, on

USE AND ABUSE OF EXPERT MEDICAL AND SURGICAL TESTIMONY AND SOME RECOMMENDATIONS FOR INCREASING THE VALUE OF SUCH TESTIMONY.

This very interesting paper was discussed by R. HARVEY

REED, Ohio; R. S. HARNDEN, New York; A. D. BEVAN, Illinois; MILTON JAY, Illinois; W. A. WARD, Ohio; W. J. GALBRAITH, Nebraska; JESSE HAWES, Colorado; D. C. BRYANT, Nebraska; L. E. LEMEN, Colorado; C. B. KIBLER, Pennsylvania; C. K. COLE, Montana.

On motion of DR. R. HARVEY REED, a vote of thanks was extended to Mr. MATHER for his able address.

The PRESIDENT stated that DR. J. F. PRITCHARD was unable to be present to read his paper. On Motion of DR. KIBLER it was resolved that all papers of Fellows who were unable to be present should be read by title and referred to the Publishing Committee.

Meeting on motion adjourned.

SECOND SESSION.—WEDNESDAY, SEPT. 23, 1896, 2:30 P. M.

The meeting was called to order by the President and a paper read on

THE PERSONAL EQUATION AMONG TRAINMEN; ITS IMPORTANCE EQUAL TO OR GREATER THAN THE COLOR SENSE,

by DR. ROBERT TILLEY, of Chicago, which was discussed by DR. D. C. BRYANT, Nebraska.

The PRESIDENT—The next paper for the afternoon session is on

PENETRATING WOUNDS OF THE EYE BALL,

by ARCHIBALD G. THOMPSON, M.D., Assistant Oculist of the Pennsylvania Railroad, Philadelphia.

The PRESIDENT—Gentlemen, we have three other papers on this same subject. Unless you otherwise order, I will call for the next paper,

PENETRATING WOUNDS OF THE EYE BALL,

by DR. REDELINGS, Marinette, Wis.

The PRESIDENT—We have still another on the same line,

PENETRATING WOUNDS OF THE EYE BALL,

by DR. D. C. BRYANT, Omaha, Neb.

The PRESIDENT—These papers are now open for discussion. They were discussed by DRS. WARD and BRYANT.

The PRESIDENT—Anything to say, DR. THOMPSON?

DR. THOMPSON—Nothing.

The PRESIDENT—DR. REDELINGS?

DR. REDELINGS—Not anything.

The PRESIDENT—If not, the discussion will be closed on this subject and we will take up the next paper. I perhaps ought to have mentioned this morning that the demonstration of the Roentgen Process of Diagnosis will be given this evening at 8 o'clock by DR. O. L. SCHMIDT at the Schiller Building. It is entirely informal. There is a hall and several rooms which I think will accommodate all who attend. You can go from room to room and study the process I think to your satisfaction—it is entirely informal.

The next paper on the program is

THE REMOTE EFFECTS OF BONE TRAUMA,

by DR. D. S. FAIRCHILD, of Clinton, Iowa. This able paper was discussed by DRS. REED, E. M. DOOLEY, C. K. COLE, W. J. GALBRAITH, WARD, BALDWIN (Salt Lake City) and FAIRCHILD.

The PRESIDENT—Any further discussion on this paper?

DR. ORTEGA, Chief Surgeon Mexican International R. R. C. P. Diaz, Mexico—May I say a few words about fractures not mentioned in the discussion?

THE PRESIDENT—Does it bear on this subject?

DR. ORTEGA—It is not a discussion of the paper, but I think it is in relation to it.

THE PRESIDENT—Well, I suppose so. If we find it is not in order we can delay it to a more opportune time.

DR. ORTEGA—I understand all the doctors in the United States know the treatment of the practice of Dr. Champina's massage movement, but I notice no one does that in this or other cities where I have been, and I want to call your attention to this treatment.

THE PRESIDENT—I beg your pardon, but I think it is not in order. The discussion is on bone trauma and not fracture, as I understand it, and the treatment you speak of does not bear on the previous paper or the discussion.

DR. ORTEGA—I do not know about that. This treatment relieves the pain.

THE PRESIDENT—There is nothing in the paper on which it bears, I think. Another opportunity will be offered you later on. Any further discussion on the paper?

DR. COLE—DR. EAGLESTON is here from Seattle and is a candidate for membership in the Academy. He desires to say something in this discussion.

THE PRESIDENT—If there is no objection, we extend the courtesy of discussion to DR. EAGLESTON.

THE PRESIDENT—If there is no objection, I think we might ask DR. ORTEGA to make the remarks which he began a few minutes ago. We will be glad to hear from DR. ORTEGA. Who spoke at length on the massage treatment of fractures.

THE PRESIDENT—Before announcing an adjournment, I would like to have a meeting of the Executive and Publishing Committees immediately after adjournment. The meeting stands adjourned.

THIRD SESSION—THURSDAY, SEPT. 24, 1896, 9:30 A.M.

DR. J. E. OWENS in the chair.

The question of publishing the transactions and papers of this meeting was left in the hands of the Publishing Committee. On motion of DR. LEMEN, DR. BAKER was allowed the privilege of the floor.

THE PRESIDENT—The first paper to be presented this morning is

FIRST AID IN RAILWAY EMERGENCIES,

by CAPT. JAMES E. PILCHER, M.D., Medical Department, U. S. A., Columbus Barracks, Columbus, Ohio.

This admirable paper was discussed by DRS. HENRY HATCH, Illinois; R. HARVEY REED, Ohio; SMITH, Illinois; L. S. MCCURDY, Pennsylvania; R. S. HARNDEN, New York; M. GARDNER, California, and J. E. PILCHER, U. S. A.

THE PRESIDENT—The next paper is entitled

A NEW SPLINT FOR NASAL FRACTURES AND DEFORMITIES,

by JESSE HAWES, M.D., Division Surgeon, U. P. R. R., Greeley, Colo.

THE PRESIDENT—I wish to remind you that the afternoon session will be held at the Chicago Medical College at 2:30 P.M. Some of the gentlemen wish to use a cadaver for demonstrating their papers.

DR. HAWES—I will first pass these photographs around that you may the better get an idea of the subject.

Those who discussed this paper were DRS. E. M. DOOLEY, New York; C. B. KIBLER, Pennsylvania; L. E. LEMEN, Colorado; C. K. COLE, Montana; W. J. MAYO, Minnesota; D. C. BRYANT, Nebraska, and JESSE HAWES, Colorado.

THE PRESIDENT—This is all we have on the program for the morning session. I am informed that DR. R. S. HARNDEN is prepared to read his paper. If it is your pleasure that he read it now the Doctor will proceed.

THE DELIRIUM OF SHOCK.

by R. S. HARNDEN, Surgeon Erie Railway, Waverly, N. Y.

THE PRESIDENT—The discussion will be opened by DR. MILTON JAY, Chief Surgeon C. & E. I. Ry., Chicago, Ill.

This paper was further discussed by C. K. COLE, R. HARVEY REED, D. C. BRYANT and R. S. HARNDEN.

On motion, adjournment was taken to 2:30 P.M.

FOURTH SESSION—THURSDAY, SEPT. 24, 1896; 2:30 P.M.

Held at Chicago Medical College.

THE MEDICO-LEGAL ASPECT OF FLOATING KIDNEY,

by R. HARVEY REED, Chief Surgeon C. S. & H. R. R., Columbus, Ohio.

DR. REED'S paper was illustrated by a cadaver, following which it was discussed by DRS. GALBRAITH, Nebraska, ANDREWS, Illinois; LEMEN, Colorado; OWENS, Illinois; RANKIN; HARNDEN, New York; HAWES, Colorado; COLE, Montana. and closed by REED.

THE PRESIDENT—The next paper will be on

PAST AND PRESENT OBSTACLES TO THE RADICAL CURE OF HERNIA,

by E. WYLLYS ANDREWS, M.D., Surgeon Wabash Railroad, Chicago. DR. ANDREWS demonstrated the points of his operation for hernia on a cadaver, after which it was discussed by DRS. COLE, Montana; MAYO, Minnesota; EAGLESTON, Washington, and others.

DR. KIBLER—For this very able illustration of the methods as given today I would move a vote of thanks to DR. ANDREWS.

Motion seconded by DR. REED; put and unanimously carried.

DR. REED—I would like to add that the Doctor be requested to submit his paper for publication in our transactions.

THE PRESIDENT—It belongs to us.

THE PRESIDENT—We have finished the program for this session. What is your pleasure?

DR. DANIELS—As quite a number of the members availed themselves of the apportunity to witness the exhibition of the Roentgen ray process, I wish to offer this resolution:

Resolved, That the thanks of the Academy be tendered to DR. O. L. SCHMIDT for the beautiful and instructive exhibition of the Roentgen rays, given at his laboratory last evening for the benefit of our fellows; the same being greatly appreciated by the members present. The Secretary to transmit a copy of this resolution to DR. SCHMIDT.

Resolution unanimously adopted.

On motion the meeting adjourned.

FIFTH SESSION.—FRIDAY, SEPT. 25, 1896. 10 A.M.

The meeting was called to order by Vice-President LEMEN.

DR. C. K. COLE was appointed sergeant-at-arms.

The Secretary's report was presented by the Executive Board, signed and approved by C. M. DANIELS, MILTON JAY and M. GARDNER.

The Treasurer's report was also presented, signed and approved by C. M. DANIELS, MILTON JAY and M. GARDNER.

REPORT OF PUBLICATION COMMITTEE.

DR. R. HARVEY REED, Editor, reported progress relative to arrangements for printing the proceedings similar to last year.

DR. COLE wished to have the whole matter left to the Publication Committee.

A resolution was submitted by DR. HAWES that the matter of printing the transactions of the Academy be left with the Publication Committee with power to act. Seconded and carried.

Resolved by DR. JESSE HAWES, that the difference between this organization and the publishers of the JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION in the matter of the publication of our transactions for the past year; also that the arrangements for the publication of our papers and transactions for the meeting of 1896, shall be left with the Executive Board and Publication Committee with power to act. Seconded and carried.

Numerous letters and telegrams were received from various members and read by the secretary, many of them expressing regret at being unable to attend and wishing the Association

success, others referring to executive work which received the prompt attention of the Academy. Among these may be mentioned DR. H. J. WILLIAMS, Macon, Ga., who wrote that one of his children was severely ill and prevented him from attending the session. He stated that his paper

TREATMENT OF TRAMPS AND TRESPASSERS,

was written and awaited the action of the Publication Committee. DR. REED moved that DR. WILLIAMS' paper be read by title and referred to the Publication Committee. Seconded and carried.

A letter from DR. GEORGE W. HODGEBOOM, Chief Surgeon A., T. & S. F. R. R., Topeka, Kan., dated Sept. 22, 1896, expressed his regret that a recent illness had prevented him from being present. He wished every success to the American Academy of Railway Surgeons.

It was moved by DR. REED, that the election of officers for the coming year be proceeded with. Seconded and carried. The balloting resulted in the election of the following officers:

President—DR. L. E. LEMEN, Denver, Colo.

First Vice-President—DR. M. GARDNER, San Francisco, Cal.

Second Vice-President—DR. R. ORTEGA, C. P. Diaz, Mexico.

Secretary—DR. D. C. BRYANT, Omaha, Neb.

Editor—DR. R. HARVEY REED, Columbus, Ohio.

Member of Executive Board, DR. W. R. BLAKSLEE, Forest City, Pa. Term expires 1900.

Member elected to fill vacancy on Executive Board caused by the election of DR. M. GARDNER as First Vice-President, DR. F. K. AINSWORTH, Los Angeles, Cal. Term expires 1898.

Place of meeting 1897, Chicago, Ill.

President-elect LEMEN stated that he had an invitation from the Mayor of Denver, and also from the Governor of Colorado, to have the next meeting at Denver, Colo. While wishing to express the thanks for the invitation, the majority of the members of the Academy favored Chicago as the most convenient place to hold the next meeting.

On motion of DR. REGER to change the by-laws relating to the admission of the honorary members; notice having been given at the annual meeting of 1895, the by-laws were changed to read "The list of honorary Fellows shall at no time exceed one hundred (100) and shall be composed of surgeons and phy-

sicians and *reputable members of allied professions.*" Subsequent to passing of this amendment the names of Hon. TRACY C. BECKER, Buffalo, N. Y., ROBT. MATHER, Esq., Chicago, Ill.; and Capt. JAS. E. PILCHER, M.D., U. S. A., Columbus, Ohio, were recommended and unanimously elected to Honorary Fellowship.

On motion of DR. COLE a vote was taken on applicants for Fellowship.

The following surgeons were elected by a unanimous vote of all Fellows present:

Dr. H. A. Argue, Surg. Erie R.R., Corning, N.Y.

Dr. T. J. Redelings, Surg. C. & N. W. R.R., Marinette, Wis.

Dr. W. J. Mayo, Surg. C. & N. W. R.R., Rochester, Minn.

Dr. J. B. Eagleston, Div. Surg. Great Northern R.R., Seattle, Wash.

Dr. W. W. Grant, Surg. C., R. I. & P. R.R., Denver, Colo.

Dr. D. H. Coover, Surg. U. P. R.R., Denver, Colo.

Dr. Bacon Saunders, Surg. G. C. & S. Fe R.R., Ft. Worth, Texas.

Dr. James Burry, Chief Surg. S. C. S. & E. R.R., Chicago, Ill.

Vice-President LEMEN—The first paper this morning is

THE CAUSE AND MECHANICAL TREATMENT OF SUBLUXATION OF THE KNEE JOINT.

By S. L. MCCURDY, Surgeon Penn. Cenl. R. R.. Pittsburgh, Pa., which was discussed by DRS. LEMEN, Colorado, MAYO, Minnesota, JAY, Illinois, and closed by MCCURDY.

On motion the meeting adjourned to 2:30 P.M.

SIXTH SESSION—FRIDAY, SEPTEMBER, 25, 1896.

Meeting called to order by President OWENS.

The President-elect announced the standing committees for the year which are as follows:

COMMITTEE ON TRANSPORTATION.

Dr. W. J. Galbraith, Omaha, Neb.

Dr. A. D. Bevan, Chicago, Ill.

Dr. A. C. Scott, Temple, Texas.

COMMITTE OF ARRANGEMENTS.

Dr. J. E. Owens, Chicago, Ill.

Dr. Jesse Hawes, Greeley, Colo.

Dr. C. D. Evans, Columbus, Neb.

The PRESIDENT—The first paper will be read by DR. W. A. WARD, Conneaut, Ohio, on

COMPOUND COMMINUTED FRACTURES AT THE KNEE WITH REPORT OF A CASE.

This paper was discussed by DRS. SCOTT, Texas, REED, Ohio, and closed by WARD.

The PRESIDENT—The next paper is on

THE RELATION OF TUBERCULOSIS OF THE KNEE TO INJURIES OF SAID JOINT.

BY H. REINEKING, M.D., Sheboygan, Wis.

This paper was discussed by Prof. RIDLEN.

The PRESIDENT—The Fellows will now listen to a paper by E. M. DOOLEY, M.D., Buffalo, N. Y., entitled

FRACTURES OF THE FEMUR.

The members who discussed this paper were DRS. GARDNER, California; COLE, Montana; GALBRAITH, Nebraska; LEMEN, Colorado; REED, Ohio; HARNDEN, New York; MAYO, Minnesota; SCOTT, Texas, and RIDLEN.

THE PRESIDENT—The next paper is on

SYNOVITIS OF THE KNEE JOINT.

DR. REED—Allow me to say that this paper was disposed of by title this morning. While I have the floor I wish to call attention to the fact we have a distinguished member of this Association who had his paper in a satchel, and I would like to have that paper presented, because in looking over this program I find that this Academy has continued to keep up its reputation for doing good work and lots of it. We have presented to this Academy over 73 per cent. of all the papers announced on the program, and if we had this paper it would be over 75 per cent., and therefore I would like to hear from our distinguished ex-President, DR. COLE. (Applause.)

DR. COLE—Mr. President, I took occasion to explain to you personally the fact that my paper—concerning which I received a telegram yesterday that it would be here to-day—failed to come. You suggested that I might discuss the contents of my paper extemporaneously, and if DR. REED and the other gentlemen will agree to remain—it will take me *two* (?) or *three* (?) hours to go over the field—I will take the field and enlighten the gentlemen who are so exceedingly kind—otherwise I will

ask to be excused. But speaking seriously, I regret that my paper is not here, and it is not through any fault of my own; the paper I expected to read, together with other valuable papers, was lost in changing cars, and the satchel which contained it has not reached Chicago yet.

THE PRESIDENT—I would like to ask DR. COLE if it would be agreeable to have his paper read by title and referred?

DR. COLE—If the Academy wishes.

Whereupon the following motion was offered and unanimously adopted:

Resolved, That DR. COLE'S paper be read by title and referred to the committee on publication.

THE PRESIDENT—That finishes our program. The next element in the afternoon session is the introduction of the President-elect. I will select DR. HARNDEN of New York, and DR. REED of Ohio, to transport the President-elect to this table so that he may be introduced to those who are not acquainted with him.

THE PRESIDENT—Fellows of the Academy, I have the pleasure of introducing the President-elect, DR. LEMEN. (Applause.)

DR. LEMEN—Gentlemen, while I was considerably surprised this morning at being elected your President, I can but say I feel highly complimented, and in accepting the position I must say that my every endeavor shall be to make the session of the Academy for 1897 the banner session of its existence. (Applause.) I do not expect to do this alone; I expect to have the hearty coöperation of every member of the Association, and I want to say now and here, if a communication should come to you from me asking you to contribute, please, instead of throwing it in your waste basket or laying it on your desk with the expectation of writing in a few days, make it a matter of immediate business to reply and reply in the affirmative. I ask the aid of you all; it is no easy task, as DR. OWENS and DR. COLE, who have preceded me in this position, will say. It is a position that every gentleman who desires good scientific papers, takes hold of with a great deal of trepidation. I feel very much as did the Irish girl when her lover kissed her, she said it gave her flirtation of the heart. It gives me considerable disturbance about the heart when I think of the responsibility I have assumed to-day in accepting this position. (Applause.)

DR. REED—I wish to make a motion that the Academy extend to the retiring President our heartfelt thanks for making this one of the most interesting and successful sessions of the Academy.

Motion unanimously prevailed.

On motion of DR. WARD, a vote of thanks was tendered the managers of the Auditorium Hotel for numerous courtesies shown to members of the Academy.

Motion unanimously prevailed.

DR LEMEN—Mr. President, we do not wish to overlook the fact that owing to sickness our regular Secretary has been unable to attend, and at the first session of this meeting we asked our competent and worthy friend DR. DOOLEY--the poet of the Association, by the way—to act in this capacity, and he donated his services. I move you that we extend to him also a vote of thanks of this Association for having served so faithfully.

Motion unanimously prevailed.

THE PRESIDENT—I can not let this opportunity pass without thanking the Fellows of the Academy for their ready coöperation in the proceedings, the prompt responses in discussion, all of which have very materially helped me to perform the functions of the office.

THE PRESIDENT—The Academy stands adjourned to meet in Chicago, September, 1897.

CHAPTER II.—PRESIDENT'S ADDRESS, ETC.

MEDICAL AND SURGICAL EXPERT TESTIMONY.

BY JOHN E. OWENS, M.D.
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Medical and surgical expert testimony is frequently so unsatisfactory and useless to the attorney, who seeks for truth; to the judge, whose desire is the administration of justice; so subversive of the dignity and good name of the medical profession, and yet so helpful to the unscrupulous lawyer, who duly thrives and fattens at the expense of his client, that the subject must surely be worthy of your earnest consideration. As the matter now stands, it is too often a farce, and some of our ablest and most conscientious attorneys, being strongly impressed with its inutility in many cases, and disgusted with the senseless wrangle which instructs neither judge, the bar or the jury, are much inclined to get along without it. Does it not bring discredit to the medical profession that experts and medical attendants, on the side of the plaintiff, testify along certain lines, and that those on the side of the defendant so often give testimony diametrically opposite in character? Let me remind you that there is no justification whatever for this state of things in our text books, which set forth in

unmistakable terms the symptoms, pathology, prognosis and treatment of the various injuries and diseases of the human being.

A physician who has gained more or less knowledge of an injured person is summoned to testify as to the facts in a case as an ordinary witness. Before his services as such are dispensed with, he is almost always put in the position of a medical or surgical expert, and his opinion is asked on certain points in the case, in this capacity. Particularly if he is a man of limited experience, or of no experience in the matters in question, he is flattered because appealed to before the court, jury and others, to give "his" opinion as an expert. It is seldom that such a witness loses sight of himself and endeavors to base his answers on those principles which guide all of us at the bedside. Usually the less experienced, the more emphatic and positive is the expression of "his" opinion. This pride of opinion often leads him to set the teachings of the books at defiance.

Questions which seek to draw out the individual opinion, are as a rule, in bad form, and particularly so if the witness lacks that experience which enables him to make a proper application of the principles and practice of medicine and surgery—experience which leads the way to correct conclusions.

A brakeman either fell or jumped from the top of a moving freight train. The palpable injuries consisted of contusions and abrasions of the nose, left shoulder, wrist, thigh and right side of the chest. The patient ran a mile, chased a steer that escaped from one of the cars, and was on his feet for six hours. He reported at the surgeon's office the following day.

Recovery from the injuries above named were speedy, but he continued to complain of illy defined pains in the right side of his chest extending to the epigastrium. A physician testified that the patient undoubtedly suffered from chronic and permanent inflammation of his solar plexus; that he could not be fooled as to the existence of pain; that the solar plexus "is something you can't be fooled on;" that the patient would keep the inflammation of the solar plexus the balance of his life. He further testified that he thought he had seen another case of inflammation of the solar plexus, but did not want to swear to it; that he never saw a case of this nature described in the most comprehensive work. And yet, on this notoriously inadequate data, derived from a patient who furnished essentially subjective evidence, a most emphatic and positive diagnosis was made, and the prognosis was formulated with equal emphasis.

Dec. 31, 1891, an engineer weighing 212 pounds, jumped from his engine to avoid a collision. He came under care immediately, and in five days went home. His injuries consisted of severe contusions of left hip and arm and of scalp wounds, the latter of which healed by first intention in a few days. Suit having been entered, in about three years the case came to trial. The evidence presented by the plaintiff's physician went to show that a marked varicosity of the veins of the left leg was produced by this accident, and that this condition was fully developed in two weeks. The physician who testified had been engaged in practice for twenty-six years. The varicosity was marked and well developed below the knee, and several veins in the same condition reached the

saphenous opening. The history of the case, while the patient was under my care, did not record injuries to the leg below the knee, nor was there any complaint that directed our atttention to the veins. My fault here was in failing to examine all parts whether complained of or not.

One must feel certain, however, that were this development of veins possible in fourteen days, complaints would have been inevitable. My testimony was to the effect that the development of varicose veins above noted was not only not possible in two weeks, but was not even so at the end of four months. There is nothing in the pathology of this condition, with its dilatations, saculations, and ruined valves that could justify such a conclusion. He prescribed for the patient three months. The doctor further testified that this patient having previously received "an injury," followed by a difficulty in passing water, containing sediment and possessing a strong odor, and having obstinate constipation, probably suffered from concussion of the spine, and that if numbness of the leg existed concussion of the spine was certain; that said concussion was progressive and permanent. What would be thought of this emphatic diagnosis of concussion of the spine, should an effort be made to maintain it, on such data, before one of our medical societies? Moreover, this patient had been hunting, and had been running his engine for three years and upward. The examination of this witness continuing, he stated that he would advise a patient suffering from an injury to the spinal cord, or a concussion, to work as a locomotive engineer; and that it would not be very injurious, but that he did not know of a man

suffering from such an injury of the spinal cord who was able to work on his engine, almost constantly, except this plaintiff. The treatment would seem to parallel the diagnosis. When this gentleman was asked if he found any of the authorities consulted by him, citing a case where varicose veins appeared in three or four weeks after a jar, answered that the authorities were very reticent on that point. So much for individual opinion. The thread of error, which ran through this case from the first, naturally lead the attorneys to submit this question to a professor of surgery: "Assuming that on December 31, the left leg was as healthy as the right, and that at that time he jumped from an engine, running at a high rate of speed, and received severe bruises extending down his left side, from the hip to the foot, and in front of the leg on the joint, and that, between two and four weeks, varicose veins began to show themselves, and have been gradually growing worse, what would you say was the cause?" Answer: The injury. There was no distinction made here, you will observe between bruises and ecchymosis. How to dispose of "assumptions" in medico-legal practice is perhaps not for us to determine. Certainly nothing is *assumed* in pathology, but assumptions are notoriously common in the court room. Many, if not all of us, must be firmly convinced that there is no claim, however absurd, no assemblage of symptoms however unique and unmeaning, and widely at variance with principles and practice as set forth in our text books, and taught in our best colleges, but that doctors can be found who are not only willing, but who do actually, by testimony, endeavor to establish. As the

matter now stands, it is extremely easy to secure such favorable witnesses by the use of the attorney's drag-net. The most absurd claim in this way may be established in the courts. Let me cite another case which has not yet come to trial, but one which the medical attendant believes in and is ready to support, namely, the claim of a woman, the mother of nine children, who suffered a falling of the womb, fully one-half of the organ being external to the vulvæ, and accompanied by a cystocele, and said to have been caused by a collision, in which the patient was thrown against the front seat, and then backward against the seat upon which she had been sitting. It is maintained that this condition, in the degree above named, required only two weeks for its development. Many of you have doubtless observed that the evidence presented by the defendants, in cases of personal injury, is in no material degree essential, as evidenced by the attitude of the jury in their verdict. Judge William H. Francis in the following words reminds us of this state of things (*Medico-Legal Journal*, March, 1896): "In the verdicts of juries against corporations, a feeling of prejudice is almost universally acknowledged, and the attorney for the plaintiff feels reasonably certain of gaining the case provided it goes to the jury." "The expert testimony of the experienced railway surgeon is often regarded as of less weight than the testimony of the plaintiff himself." We all know how unique are the symptoms and the details of complaints made by the patient of his sufferings and feelings in cases of personal injury, and often, how much these vary from anything found in the literature of our profession. I have more than once closely

watched juries in personal injury cases and have noted the interest taken in plaintiff's testimony, and the toleration, rather than interest, that was manifested toward the witnesses of the defendant. It would seem to me that such juries, perhaps unwittingly, owing to the deep-rooted prejudices against railways, have two objects in view, namely, first to hear the plaintiff describe his or her sufferings, and the supporting testimony of medical and surgical experts. Second, to determine as speedily as possible the amount that should be paid. The evidence, to show the fraudulent nature of the claim and the exaggeration of the symptoms is but little considered. Besides, one may imagine the tumult in the mind of the honest jurors when the doctors on one side make certain statements, and those on the other offer testimony of a diametrically opposite character. How can we expect the most intelligent juror to harmonize these conflicting statements and arrive at a just conclusion, to say nothing of a juror who may be less intellectually favored? What is the natural result? Rather than to take the chance of doing an injustice to a presumably injured person, the verdict is rendered in his favor, often for a large amount. The experienced honest medical and surgical expert, in many instances, with a full knowledge and appreciation of all the facts, concludes that the verdict was rendered solely for the purpose of punishing the corporation. I have been interested in trials where witnesses were so questioned as to bring out very little information for the use of either side, and the court itself was but little if any benefited by the medical witnesses. The unbiased truth would be best for all sides, but there is

no certainty whatever of securing it under the methods now in vogue in this and in other States.

The science and administration of justice in cases of personal injury, require the consensus of opinion of the medical profession as set forth in our text books, and not so much the private or individual opinion of the witness. These text books should be used more frequently in the courts, not as is usual for the purpose of entrapping the witness, but as an aid to the witness and to the court, just as legal authorities are employed. Opinions that materially vary from them should not be accepted.

In 1889 a girl 14 years old, the victim of a crossing accident, suffered a fracture of the collar bone as well as two or three scalp wounds. The patient was conscious, but in a highly nervous state. Several months after the accident a piece of loose bone was removed from the clavicle. About this time twitchings of the hands, arms and left side were observed. The day following the operation the patient had a series of convulsions. These convulsions were seen daily the following week, and continued a month. There were jerkings of the limbs, rigidity and alternate relaxation followed by a similar seizure, after which she got up, declaimed, sang songs, whistled, and then from exhaustion fell over in a state of quietude. Her physician had known her to hiccough for three hours. The abdomen became tympanitic in a marked manner. Any excitement easily caused a renewal of the attacks. She had smaller seizures, such as stiffening of arms and legs. Hystero-epilepsy was diagnosticated. In addition to the symptoms just noted, there existed left hemianesthesia, impairment of color sense, contrac-

tion of the field of vision of the left eye, loss of the sense of smell, and those of taste and hearing on the left side. There was no perceptible difficulty in walking, but she could not use the left hand as in washing cups, etc., longer than ten or fifteen minutes without dropping something. There was no biting of tongue or frothing of the mouth; no coma. A needle thrust into the left side, arm or leg was unfelt. The sizzing of the galvano-cautery could be heard and the vapor therefrom seen, but the result was absolutely negative. She could taste sugar with the left half of the tongue, but not with the right. The tick of a watch could only be heard when placed against the left ear; grasp of left hand was normal. She seemed to delight in trying to mislead, and her mind was in a fickle and uncertain state. She had never menstruated. This condition lasted until the time of the trial, during which she was seized with a violent convulsion in court, and was carried out screaming. The physician in attendance testified that the symptoms would be permanent. Others testified that were the patient removed from the family, freed from morbid curiosity of which she was the object, and of the unnatural solicitude that was lavished upon her, with a very little medicine, in six months, she would probably recover. A gynecologist testified that if she remained well for two years, marriage would be safe. In this case, so very interesting in many respects, we find one opinion as to the permanency of the affection, and others promising recovery with proper treatment. We think that the consensus of opinion of the profession is in accord with the latter prognosis.

Judge Abram H. Daily remarks that "surgeons of

humanity and love of fairness are advancing in importance to the railroads," and I may add, likewise to the injured. The only prejudice that exists against railway surgeons is to be found amongst quack lawyers. Not long since my assistant and myself, several days after an accident, visited a patient at the request of a company, for the purpose of taking charge. We were met at the head of the stairs by a stalwart fellow who stood guard and informed us that he had instructions from the attorney not to allow any railway surgeons to enter. In this way, the case could be nursed along, and the demands on the railway company could become more extravagant. Note an additional extract from Judge Daily's paper: "The attorney who is guilty of making use of false evidence in a court of justice should not only be debarred from further practice, but subject to a criminal procedure." As railroad surgeons, our responsibility to the injured is in no sense diminished by the fact that we are employed and remunerated by railroad companies. Our first aim must be the faithful discharge of our professional duty to the patient.

I have never been called upon by the railways with which I am connected to perform the services of a claim agent in any sense, and I have moreover never encouraged this on the part of any of our surgeons. All that I have insisted on is a faithful discharge of professional duty to the patient, and a fair and honest report of injury and disability, if any. Any activity in the direction of a settlement of claims has been the subject of grave and adverse criticism by the court, and the surgeon is thus brought into disrepute, and the profession proportionately degraded. "In ventur-

ing an opinion as to the nature and extent of the injuries of the patient under our charge, we will be held to the exercise of a high degree of skilled knowledge as well as integrity by the courts."

It is most remarkable that all of the States of the Union have not passed a law permitting, where desirable, a physical examination of parties who lay claim to injuries and seek compensation for the same. The position so often taken by the attorneys for the plaintiff, even after their client has been subjected to the study of one or more of their own doctors, is that it is disagreeable, indelicate and against the wishes of their client, and if a woman, that modesty forbids further examination, and that they themselves object to it. May we not with propriety ask who gave the plaintiff's medical witnesses and examiners a monopoly of delicacy, morality and of that gentleness and propriety that must characterize every physician in his relation to his patient, or to the patients of others? It must be quite right that both attorneys and patients, or either, should have the privilege of objecting to certain examiners, but it is not just or conducive to the administration of justice that a physical examination be denied the attorney for the defense when desirable. The new law passed in New York compelling plaintiff to submit to a physical examination in damage cases, settles the question of giving that right to plaintiff exclusively. The plea that it would outrage delicacy or modesty is not a valid objection.

In regard to the law permitting examinations, other States should follow, and there is no State in the

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[illegible] and Responsibility of the Attending Physician in cases of [illegible] from a Lawyer's stand-point by Judge Abram H. Daly, [illegible] Journal, March, 1896.

Union where this law is so much needed as in Illinois, where quack lawyers are so numerous and so ravenous; and where, so far as I am aware, there is no restraint whatever put on them by the bar association, and little or none by the courts. The Fellows of this Academy should use their influence in this direction.

The courts desire an accurate ascertainment of facts. In personal injury cases, the erroneous conclusions and wrong theories set up by certain doctors and fanned into a flame by attorneys, seriously clog the wheels of justice. The plainest and best sustained opinions of the honest medical and surgical expert are too often misinterpreted by the attorneys as evidenced by their cross-examination. No science is so frequently called upon by the courts for evidence, and the physician should be one of the most satisfactory witnesses, but such is notoriously not the case. It might be expected that he would see nothing but the truth and established facts in connection with the matter subjected to him, but the hopeless conflict of medical testimony tells a different story and nullifies that which, under other methods, would be a desideratum. Among the causes for the present condition of the matter now under consideration may be mentioned the present method of securing expert medical and surgical experts; ignorance, dishonesty, partisanship, pride of opinion, want of preparation and the skill displayed by certain attorneys in bringing about a conflict of medical testimony in order to weaken the evidence that may be unfavorable to the two sides respectively; a failure to appreciate the fact that *no one* is competent to testify as an expert

in *all* departments of medicine and surgery. The witness employed as an expert should have the proper qualifications. Clark Bell says, "An expert is one who has made the subject on which he gives his opinion a matter of particular study, practice or observation, and he must have a particular special knowledge upon the subject concerning which he testifies."[2] Suggestions have been made for remedying this evil as for instance the following:

"A court should be authorized by law, or by agreement of parties, to appoint a commission of one or more disinterested and unbiased physicians to investigate the medical questions in concert, and make a report or testify as to the findings." "Every facility for investigation should be afforded by the parties." "If the parties should not agree, the court should seek to appoint only those of the highest reputation in the vicinity." "The position would be an honorable one, and the conclusions would be honest."

It has also been proposed, that, by an act of legislature, the judges of the various courts be permitted, yearly, to elect a Board of Experts in each department of the medical sciences, paying the same out of city or State funds, so that when expert testimony, relative to any subject is required, that particular board of experts should by order of the court convene to discuss the same from a scientific stand-point, and investigate by chemic and physical analysis. Either side might retain scientists to conduct examinations, but the testimony of such scientists should be confined to the board of experts, and after such testimony is submitted and the board of experts has finished its

2 The Medico-Legal Journal, December, 1893, page 307.

investigation, the report handed to the court by such board should be considered expert testimony. Finally whether this would be best or not, I am not prepared to say at this time, but certainly some laws should be enacted through the operation of which the dignity of a scientific profession will be upheld, and medical and surgical expert testimony be entitled to the respect of the judiciary and the honorable members of the bar.

THE USE AND ABUSE OF EXPERT MEDICAL AND SURGICAL TESTIMONY AND SOME RECOMMENDATIONS FOR INCREASING THE VALUE OF SUCH TESTIMONY.

BY ROBERT MATHER,
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CHICAGO, ILL.

Expert testimony has no logical place in the common law theory of trial by jury. The admission of it, indeed, violates one of the cardinal principles on which the system is founded. The legitimate function of testimony in courts of law is to make known the facts relative to the cause in controversy. Inasmuch as these facts in general rest in the knowledge and recollection of persons, the ordinary medium for the ascertainment of them is the living witness. Owing to the infirmities of human nature, it results that the facts made known in a legal controversy through this medium are often, if not always, uncertain, confusing and contradictory. To deduce from this mass of uncertainty, confusion and contradiction a just conclusion as to the truth of the matter is the proper province of the jury. It is the theory of the law that in the process by which the jury deduce from the mass of facts laid before them the ultimate conclusion of fact which forms the basis of their verdict, both the judge and the witness are rigidly excluded. The

judge is confined to the dry domain of the law; the witness to the bare region of fact. Into the bright realm of speculation upon the facts, where are conceived and brought forth those marvelous children of chance known as jury verdicts, neither may enter. The lot of the witness in this respect is even harder than that of the judge. The latter is not confined to telling the jury what he *knows* the law to be; he may, and frequently does, instruct them as to what he *thinks* it to be. But the pent-up witness is limited to the bare recital of what he knows. He may not enliven his wearisome tale by interspersing the facts with his theories; nor may he lighten the arduous labors of the jury by giving them the benefit of his opinion on the facts. Indeed, the rigid and constant effort of the theory of the law of evidence is to prevent any expression of opinion on the part of the witness.

To this general rule, the expert witness is the anomalous exception. Indeed, it is a misnomer even to call him a witness. He may have, and as a rule has, no knowledge of the facts out of which the controversy arose. He is called to tell not what he knows but what he thinks; not to relate facts but to rehearse opinions.

The reason for such a startling departure from the fundamental rule of evidence which excludes the opinion of a witness, rests on a recognized defect in our jury system. It is admitted, as the basis of this exception to the general rule, that there are certain classes of fact from which the ordinary juror is not so well qualified to draw a just and correct inference as are men who have made such facts, their phenomena and their laws, the subject of special investigation and

study. And so, such facts being in evidence, the expert—the man experienced in the science or art to which these facts belong—is called, not to add to the mass of facts involved in the controversy, but to assist the jury in the performance of its legitimate function of deducing inferences from the facts. In other words, the expert witness is not properly a witness at all, but rather an assistant to the jury.

The expert was an early graft on the growth of the law of evidence; and it is an instructive and significant fact that it was in the capacity of an assistant to the court that he first won his anomalous place in our system of jurisprudence. His first appearance was as an adviser of the court or judge in matters of science or learning in which the court admitted its deficiency. In a case decided as early as 1555, it was said by Saunders, J.: "And first I grant, that if matters arise in our law which concern other science or faculties, we commonly apply for the aid of that science or faculty which it concerns. Which is an honorable and commendable thing in our law. For thereby it appears that we do not despise all other sciences but our own, but we approve of them and encourage them as things worthy of commendation. And, therofore, in 7 H. 6 in a case that came before the judges, which was determinable in our law, and also touched upon the civil law, they were well content to hear Huls, who was a bachelor of both laws, argue and discourse upon logic and upon the difference between *compulsione præcisa et causativa*, as men that were not above being instructed and made wiser by him. And in an appeal of mayhem the judges of our law have used to be informed by surgeons whether it be a mayhem or

not, because their knowledge and skill can best discern it." (Buckley v. Rice Thomas, I Plowd. 122.)

How much the science of medicine and surgery owes to this complacent approval and encouragement of it, as a "thing worthy of commendation," by this ancient spokesman of the law, is not for a lawyer, speaking to physicians and surgeons, to say. We of both professions are more interested to note that, when the law first pressed the physician and surgeon into its service as an expert, it was in the capacity of instructor to the court.

The case from which my quotation is taken is both instructive as to the then position of the expert witness in the law, and prophetic of his fall from grace. It was a contested election case. Buckley, a Knight of Anglesea County, in Wales, sued Rice Thomas, sheriff of the county, to recover a penalty for returning one Lewis as the duly elected member of Parliament, whereas Buckley claimed the election. Buckley's lawyer alleged in his declaration that although (*licet*) he was elected, nevertheless the defendant did not return him, but Lewis, as the chosen Knight. The sheriff's lawyer, with scholastic acuteness, demurred on the ground that this allegation did not amount to a positive affirmation that Buckley *was* elected. The discussion of this important issue was opened by Staunford, Puisne Justice, thus learnedly:

"Then it is to be seen how the plaintiff has here alleged that he was chosen a Knight to come to Parliament. And it seems to me that he has not alleged it by a full affirmation. And thereupon the meaning of this word (*licet*) ought to be weighed and discussed. And in order to understand it truly, being a Latin

word, we ought to follow the steps of our predecessors, judges of the law, who, when they were in doubt about the meaning of any Latin words, enquired how those that were skilled in the study thereof took them, and pursued their construction. . . . So in 9 H. 7, it appears that one was bound in an obligation upon this condition, that if he paid £5 of fine gold, that then etc., and the obligation was *puri auri*, and there the judges were in doubt what was Latin for *fine* gold, and (as it appears by the book) the masters of grammar were put to give their opinion what was Latin for *fine*, and they could not tell. So that our predecessors have always consulted about the meaning of Latin words with grammarians and others that best understood them, and such sense as the grammar warrants and allows they have admitted; wherefore I apprehend that the grammar is the most proper judge of the meaning of this word, *licet* being a Latin word."

Whether recourse was had, in this case, to the grammars, rather than to the grammarians, as in the case cited from the time of Henry VII., because of the unsoundness of the latter experts on the gold question, does not appear; but it is certain that the result of calling the grammars as expert witnesses foreshadowed the modern decadence of expert testimony. The grammars called upon seem, like the modern experts, to have taken sides and swore point-blank against each other, so that when their testimony was duly considered, the judges were unable to agree. The plaintiff's grammar, however, prevailed over that relied upon by defendant; the majority of the court were convinced that *licet* could, and did, introduce a full and precise affirmation, and the plaintiff was suc-

cessful in his suit. Posterity would doubtless reverse that judgment if the record were thus open to review, not on the ground that the court misconstrued the Latin word, but because civilized sentiment would deny that the plaintiff had suffered damage by the sheriff's false return. For the parliament to which the litigious knight was elected, but in which he was saved the odium of sitting, was the execrated body that revived the barbarous statutes of Henry IV. for the punishment of heretics; and while the sapient judges of the law were maundering at Westminster over the meaning of *licet*, the recalcitrant Protestants were burning at Smithfield. The man who was prevented from sharing in that infamy ought not to be heard to complain.

The disgraceful disagreement of the grammars in Buckley' case, I have said, foreshadowed the decline of the expert witness both in usefulness and in the public estimation. It was, however, an early, though a sure antetype, and for more than two centuries after that case was decided the expert maintained his honorable and trusted position as *amicus curiæ*. A case decided in 1782 is the first, so far as I know, to reveal him in his well-known modern character of the retained advocate of a party. In that case Lord Mansfield granted a new trial on the ground that the witness had been surprised on the trial by the testimony of an expert called by his adversary on a question of science involved in the cause. It was held that he was entitled to pit his expert against that of his opponent, his Lordship saying: "In matters of science, the reasonings of men of science can only be answered by men of science." (*Folkes v. Chadd*, 3 Doug., 157.)

for in the verdict of the jury, should begin his investigation into the facts of the case with a lively hope that they might justify inferences tending to produce that result; that he should seize eagerly upon the facts that have such a tendency, and look coldly and with critical eye upon those that point another way; and that he should finally reach a conclusion in harmony with the spirit that has controlled his investigation and in consonance with his client's desires. The influence of the retainer upon both process and result, in such a case, is more insidious than open. The most mentally honest may not even be sensible of its operation, nevertheless it is there, working out its result with more or less directness and certainty.

In no class of cases is this influence unfelt. I venture to say in this presence that the discriminating railway lawyer frequently has occasion to doubt the entire fairness of the report and prognosis of the surgeon of his road in cases involving what may be called concealed injuries. The interest of the surgeon in his employer's affairs, his natural desire to save that employer from heavy loss, a pardonable pride to justify his selection as its medical adviser, trace their origin directly to the retainer or salary that secures his services. These sympathies, together with the conviction that long experience in the similar cases of his client has forced upon him that many of such claims are wholly feigned or largely exaggerated, have all, consciously or not, entered into the process that has led him to the opinion given to the legal adviser of the company. He may be, and undoubtedly is, mentally and morally honest in his conclusions, but to the extent to which his view has been perverted and

his judgment affected by these considerations, he has been corrupted by them. The situation would not be so bad if the corrupting influence of the retainer were always of the unconscious character which I have described. Unfortunately, it must be admitted that the retainer is often both given and accepted in the literal sense of the term, as a sum paid to retain the knowledge, skill and reputation of the so-called witness in the sole interest of the party who pays the fee. In such a case the influence of the retainer is direct, open and convincing. The effort of the expert thus retained, is not to lead the jury by correct and impartial deductions from the facts in evidence to a just conclusion as between the contending claims, but to develop, fortify, present and defend a theory, which, if accepted by the jury, will win his client's cause. I think I have not been unduly harsh in stigmatizing such a sale of professional standing, learning and skill as corruption; a better term would be prostitution.

A second effect of the practice of retaining experts as witnesses is to minimize and degrade the value of their testimony. A prime requisite to the credibility of testimony is that it should be disinterested and impartial. The witness to the ordinary facts of a legal controversy, though called by and friendly to one of the parties as against the other, must, if he would have his testimony weigh with the jury, relate his facts with absolute and apparent impartiality. The least inclination on his part to color his narrative for the benefit of the party producing him, discredits him as a witness and casts a cloud upon his testimony. What, then, must be the position of the expert, who it is known in advance has been *hired* to testify in favor

of the party calling him, and whose sole effort on the stand is to demonstrate that the laborer is worthy of his hire? I could weary your patience with extracts from judicial opinions which describe in more or less forcible and picturesque terms, the degraded position of the expert before the courts and the slight esteem in which his testimony is held. Your own experience, no doubt, makes such a recital unnecessary. One writer, speaking of the fee system, has said:

"Hence it is that, apart from the partisan temper more or less common to experts, their utterances, now that they have as a class become the retained agents of the parties, have lost all judicial authority, and are entitled only to the weight which a sound and cautious criticism would award to the testimony itself."—Isaac T. Woodson in *III Kentucky Law Reporter*, 477.

The method provided by the machinery of the courts for testing the worth of the expert's testimony by "a sound and cautious criticism," deserves a passing notice. The reason for calling the expert as a witness must be borne in mind:

"It is not because a man has a reputation for sagacity, and judgment, and power of reasoning, that his opinion is admissible; if so, such men might be called in all cases to advise the jury, and it would change the mode of trial. But it is because a man's professional pursuits, his peculiar skill and knowledge in some department of science, not common to men in general, enable him to draw an inference, where men of common experience, after all the facts proved, would be left in doubt." Shaw, C. J., in New England Co. v. Lovell, 7 Cush., 319.

The man thus qualified to draw an inference which

the jury must deduce before they can reach a verdict but which, owing to their want of knowledge and skill in that branch of science, they are unable to draw, is called before them to tell them what the proper inference is. He gives his opinion and his reasons for it. An advocate, more or less learned in the law, and superficially prepared for the purpose with the assistance of the opposing expert, puts the witness through a cross-examination, the object of which is not to learn the truth, but to demonstrate that his opinion is wrong, his reasons unsound, and the witness himself either ignorant, dishonest or ridiculous. The expert on the other side is then called and gives a contrary opinion, with grave and weighty reasons in support of it. The opposing lawyer then tries by cross-examination to show that this witness is as ridiculous, dishonest, ignorant and unsound as his own expert. The whole matter is then referred to the jury, who were admittedly, at the outset, incapable of drawing a correct inference, but who, edified and instructed by the dignified performance that has taken place before them, are now expected to give to the conflicting theories of the experts "the weight which a sound and cautious criticism would award" to them. The wisdom of such a final reference must be apparent; the capacity of the ordinary jury for "sound and cautious criticism" in matters of science needs no eulogy here.

This evil, however, if it be an evil, can hardly be remedied until we shall change materially our method of determining questions of fact. The really vital abuse of expert testimony, and the one which is susceptible of speedy correction, is the practice of retain-

ing the expert as a partisan advocate. Indeed, I am inclined to think that the correction of this evil will tend largely to the lessening, if it does not accomplish the abrogation, of the other. I believe, in my optimistic ignorance, that when experts shall resume their true relation to the court and jury, as advisers and assistants, there will be fewer disagreements among them than under the present system, and that such as shall occur, being honest differences of opinion, uncreated and uninfluenced by interest or partisan zeal, will be more readily and more decently reconciled. None would more quickly recognize or more readily bow to this changed condition of affairs than the members of the bar. There is no occupation that is less fruitful of results to the client or of reputation to the lawyer, than the cross-examination of an honest, intelligent and impartial witness. It is only against the ignorant, the prejudiced or the corrupt, that cross-examination is a fatal, or even an effective, weapon. And when science occupies, in the presence of its experts, the position of an honest, wise and disinterested adviser of the court and jury, the efforts to discredit both its processes, its conclusions and its representatives, to which the legal profession is now driven perforce, will, by losing their efficacy, lose their place in our trials.

The remedy for the apparent abuses of expert testimony lies in the designation by the court in each case of the experts who shall be called to testify. There is no novelty in this suggestion; it has been frequently and ably urged and, I believe, already commends itself to the honest judgment of both our professions. It will be observed, however, that I have used the

term "designation" rather than "selection" by the court. If we always and everywhere had a judiciary that was able, impartial and strictly just, from which prejudice, partisanship and demagoguery were absolutely removed, I should favor the sole selection of experts by the judges. But even my limited experience and observation make it safe to say, without injustice to the judiciary here or elsewhere, that there are tribunals in which both the parties and the blind goddess herself would prefer that the experts whose opinions are to guide the jury to a correct conclusion, should be selected by the litigants. The parties, therefore, should be given an opportunity to agree, the court to make the selection in case of disagreement. But whether agreed upon by the parties or selected by the judge, the experts should receive their appointment from the court. They should be officers of the court, sworn and acting as its commissioners for the better ascertainment of the truth.

This plan would remove the root of existing evils, the retainer system. The cause of the discredit in which expert testimony is now held being thus removed, the effect would disappear. The expert would be restored to his ancient and legitimate function of adviser to the court and jury, and, in this character, would win back his place in the confidence of the courts and the community. The use of science in the courts would be consecrated to the task of solving, instead of obscuring and confusing, those difficult questions which the law, without the aid of science, admits its incapacity properly to solve. More than this, the plan would insure the selection of actual *experts*. The medical profession, especially, knows how little this term

means in our courts. As the law now stands, the preliminary examination into the qualifications of medical men who are presented as expert witnesses is mere mummery, meaning nothing. With but very slight reservation the statement may be made that any one who practices medicine, no matter of what school, or with what little pretension to preparation, scholarship or experience may be permitted to swear to his opinion of the cause, course and probable duration and effect of the most hidden injury or the most mysterious malady. The veteran practitioner and the novice; the disciple of approved schools and the herald of a new propaganda; the profound scholar and the sciolist, all are presented to the jury with the equal sanction of the law, under the comprehensive description of "experts." Under this common guise trickery poses as skill, and assurance as wisdom. Those are the most efficient experts who can most plausibly present and most boldly defend the theory required by the exigencies of the side on which they are retained. This faculty is not a necessary accompaniment of professional learning, skill and reputation, and is not seldom found, in most effective degree, among that class of whom it has been said that their "confidence, in many cases, bears a direct similtude and ratio to their ignorance." The appointment of expert witnesses by the court would exclude this class of men and would insure the calling of experts who are not only impartial and disinterested, but who are best qualified to express an opinion on the case before the court. The parties, knowing that neither could make use of a partisan witness, would both be interested in having the witness whom the court should call chosen

from those most competent to form an opinion on the particular case. The learned would not be called upon to pit their opinion against that of the ignorant, nor the honest against the unscrupulous. Character, rather than acuteness, would count in the choice of experts; learning and skill would take precedence of glibness and pretension. Thus science would be represented in the courts by its nobler disciples, and, while justice would be better served, science would gain in reputation.

Of course practical difficulties present themselves, as they do in the path of every advance. What shall be done with the practitioner who has attended a case from its inception to the time it has become the basis of a suit, and on to the time of trial? He is clearly a competent witness to detail the facts as to his patient's condition. Shall he be confined to a recital of these facts? Or shall he be permitted, though not a court expert, to express his opinion on those questions as to which expert testimony is admissible? Assuming him to be the equal of the official experts in learning and skill, he would seem, from his long and intimate acquaintance with the case, better qualified than they to form an opinion on these questions. Yet he comes in the character of the partisan and has the taint of the retainer about him. Professional pride, as well as personal pride of opinion, sway him irresistibly to the defense of the diagnosis on which his treatment of the case has proceeded, especially if that view of the case should be questioned or assailed by the experts. But, while there is danger in the admission of his testimony as an expert, there seems to be injustice in the exclusion of it; and the better judgment, I am satis-

fied, would admit it, trusting that his prejudice or ignorance, if his testimony should reveal either, would find their foil in the wisdom and disinterestedness of the experts of the court.

A minor difficulty might be met in disposing of the question of compensation for the experts. Such is my opinion of the value of professional services, being a professional man myself, that I concede the right of an expert to a reasonable, and even a liberal fee. Nor would I keep the word of promise to the ear and break it to the hope by leaving him, for the payment of his fee, to the hazard of the collection of a bill of costs. The payment of his fee should be required of the party demanding the appointment of experts, and as a condition precedent to the appointment.

A more serious difficulty would be encountered in determining in what manner the expert should give his testimony or make his report, and how it should be treated when received. A logical adherence to the theory that the expert is the assistant and adviser of court and jury in matters about which both are ignorant would require that he report his opinion, with his reasons, orally or in writing, and that the jury should accept the opinion as conclusive of the question on which it bears. Of course, where opinions of experts differ, the jury, as in the case of conflicting testimony as to facts, must reconcile them, when possible, and accept that which is most reasonable, where the conflict is irreconcilable. And in this process of reconciling, accepting and rejecting, I suppose that cross-examination must be admitted to play its part, though the moment the official expert submits to cross-examination he loses something of his dignity and inde-

pendence as an agency and officer of the court. In France, where the plan is in operation of appointing experts as court officials, the court not only selects the experts where the parties can not agree, but determines what questions shall be put to them. American lawyers, I think, would object to that method of procedure here. In Scotland the experts make a written report, upon which they are subject to cross-examination. Such a system might not be wholly unacceptable in our courts. Certain it is, that doubts as to the proper mode of procedure should not long obstruct such a needed reform.

Thus far I have generalized, and what I have said is quite as applicable to many other kinds of expert evidence as to medical and surgical testimony. But a railway lawyer, speaking to railway surgeons on such a topic as the present must be understood by his hearers as having in mind in everything he says the special class of cases in which both are so much and so often interested. While, therefore, my observations have been general in terms, they have, no doubt, come to your minds as having special and direct reference to personal injury cases. Certainly no other class of cases more frequently displays the abuse of expert medical and surgical testimony, or demonstrates more clearly the necessity for improving the method of procuring and presenting such testimony. No doubt it is within the repeated experience of each of you that ignorant or corrupt expert testimony has presented and upheld opinions that you knew were unsound and theories that you knew to be false. The obscureness of many of the injuries which give rise to these cases and the subjective nature of their symptoms

render these achievements of the expert comparatively safe, while the sympathy that rests in the jury box for the subject of the injuries and the prejudice or indifference to the rights of the defendant which also there abide render them usually successful. Dishonesty and charlatanism among medical experts have won more cases without merit and magnified more verdicts where merit was slight, than character and learning have defeated in the one case, or diminished in the other. Nothing, more than the uniform and expected result in this class of cases, demonstrates the incapacity of our present system of presenting opinion evidence to lead the jury to a conclusion which speaks the truth. A nearer approximation to even and exact justice in the determinatian of causes arising out of personal injuries than is now possible under present methods of trial and existing rules of evidence would, I believe, be secured by the plan of selection and appointment of experts by the court.

The adoption of this plan would involve in this class of cases, a further step. The injured person should be compelled to submit himself to a personal examination by the court's experts. The right to require such an examination could not be denied to an officer of the court charged with the duty of ascertaining the truth. It would only furnish the opportunity for the performance of that duty. Indeed, some courts have held, even under the present system, that the power exists to compel such an examination by experts who are not official. Schroeder v. Chicago, Rock Island & Pacific Railroad Company, 47 Iowa, 375 (1877), was the pioneer case in that direction. The question was determined, without precedent or

authority to guide the court, on lofty ground of principle. It was said: "Whoever is a party to an action in a court, whether a natural person or a corporation, has a right to demand therein the administration of exact justice. This right can only be secured and fully respected by obtaining the exact and full truth touching all matters in issue in the action. If truth be hidden injustice will be done. The right of the suitor, then, to demand the whole truth is unquestioned; it is the correlative of the right to exact justice. It is true, indeed, that on account of the imperfections incident to human nature perfect truth may not always be attained, and it is well understood that exact justice can not, because of the inability of courts to obtain truth in entire fulness, be always administered. We are often compelled to accept approximate justice as the best that courts can do in the administration of the law. But, while the law is satisfied with approximate justice where exact justice can not be attained, the courts should recognize no rules which stop at the first when the second is in reach. Those rules, too, which lead nearer the first, should be adopted in preference to others which end at points more remote. This doctrine lies at the foundation of the rules of evidence, though it must be confessed that the superstructure does not always fully conform thereto."

Since this decision the right of a defendant in a personal injury case to demand, and the power of the court to compel a personal examination of the injured person has been much mooted, and the decisions of the courts have been not only diverse and contradictory, but wavering and inconsistent. Those States in

which the power to compel an examination is admitted either absolutely or under conditions are:

Texas: M. P. R. Co. v. Johnson, 72 Texas, 95.

Georgia: Richmond & Danville R. Co. v. Childress, 82 Ga., 719.

Alabama: Alabama Great Southern R. Co. v. Hill, 90 Ala., 71.

Minnesota: Hatfield v. St. P. & D. R. Co., 33 Minn., 130.

Wisconsin: White v. Milwaukee City Ry. Co., 61 Wis., 536.

Nebraska: S. C. & P. R. Co. v. Finlayson, 16 Neb., 578; Stuart v. Haven, 17 Neb., 211.

Kansas: A. T. & S F. R. Co. v. Thul, 29 Kas., 466.

Arkansas: Sibley v. Smith, 46 Ark., 276.

Ohio: Miami & M. Turnpike Co. v. Bailey, 37 Ohio St., 104.

Missouri: Sidekum v. W. St. L. & P. R. R. Co., 93 Mo., 400; Shepard v. M. P. R. Co., 85 Mo., 634; Owens v. K. C., St. J. & C. B. R. Co., 95 Mo., 169.

Both the right of the defendant to demand and the power of the court to require such examination have been denied in Illinois: Parker v. Enslow, 102 Ill., 272; C. & E. I. R. Co. v. Holland, 122 Ill., 461, S. C., 18 Ill., App. 418; St. Louis Bridge Co. v. Miller, 138 Ill., 455, S. C., 39 Ill., App. 366; Joliet Street Railway Co. v. Call, 143 Ill., 177, S. C., 42 Ill., App. 41; P. D. & E. R. Co. v. Rice, 144 Ill., 227; City of Galesburg v. Benedict, 22 Ill., App. 111.

The same result was reached in Indiana: T. H. & I. R. Co. v. Brunker, 128 Ind., 542. And by the United States Supreme Court in Union Pacific R. Co. v. Botsford, 141 U. S. 250; though Justices Brewer and

Brown, in a dissenting opinion by the former, gave their adherence to the doctrine of the Schroeder case in Iowa. An opinion by the Supreme Court of New York, rendered in 1868, but not published until after the Schroeder case was submitted in the Iowa Supreme Court, asserted the power to compel an examination. (Walsh v. Sayre, 52 How. Pr., 334.) This decision was afterward overruled at a general term of the Supreme Court (Roberts v. Ogdensburg & Lake Champlain R. R. Co., 29 Hun. 154) and the question was finally put at rest in that State by a decision in 1891, denying the existence of the power. (McQuigan v. D. L. & W. R. Co., 129 N. Y., 50.)

This vacillation in the courts of New York had its counterpart in the courts of Missouri, where the question as to the existence of the power was first decided in the negative and subsequently, as has been seen, in the affirmative.

The decision in the McQuigan case led to the adoption of a statute in the State of New York as follows:

"In every action to recover damages for personal injuries, the court or judge, in granting an order for the examination of the plaintiff before trial may, if the defendant apply therefor, direct that the plaintiff submit to a physical examination by one or more physicians or surgeons to be designated by the court or judge, and such examination shall be had and made under such restrictions and directions as to the court or judge shall seem proper. In every action brought to recover damages for personal injuries, where the defendant shall present to the court or judge satisfactory evidence that he is ignorant of the nature and extent of the injuries

complained of, the court or judge shall order that such physical examination be made."

This statute was enacted as an amendment to that section of the Code of Civil Procedure which provided for an examination of the plaintiff under oath. In construing the amendment, the court held (Lyon v. Manhattan R. Co., 142 N. Y., 298) that the physical examination provided for thereby was designed to be a part of the examination of the plaintiff under the section as it stood before the amendment, and that an order would not issue for the physical examination of the plaintiff, except as a part of the taking of his testimony. In other words, the defendant, in order to obtain a physical examination of the plaintiff, must call him as a witness before a referee for the purpose of taking his testimony, and as a part of this process may compel a physical examination. It was said: "The statute has in terms provided that the physical examination shall be procured in the same way and as part of an examination of the party before trial, and in that way only and by conforming to the general provisions of law on the subject can the object and purpose of the amendment ever be attained. This construction gives effect to every word of the section as amended, and is in harmony with the other sections immediately preceding and following. Then the referee becomes something more than a mere spectator at an idle ceremony. He may take the plaintiff's testimony upon the issue and report to the court as upon an examination before trial. He has, of course, the power to administer an oath and to authenticate the proceedings, and the plaintiff is bound to appear before him and answer all proper questions with respect to the nature and

extent of the injuries, whether framed by the medical experts from their own examination, or as a part of it, or by the counsel present. It becomes a fair struggle for truth and both parties may participate."

The "struggle for truth" provided for in this awkward enactment would seem to be an ordeal from which both sides would shrink. The defendant in the ordinary personal injury case would hesitate to make the plaintiff his own witness and, therefore, to be bound by his testimony, even if thereby he should secure the right, which otherwise he would not have, to a physical examination of the plaintiff and his injuries. On the other hand, if, as appears from the report of the case, the physical examination is to be part of an oral examination to be witnessed and participated in by a referee, experts and counsel on either side, it would seem that the plaintiff, especially if a woman, would rather bear the ills her injuries entailed upon her than fly to a method of relief which contemplated such an inquisition. The more satisfactory and seemly way would seem to be to compel an examination of the plaintiff's person by the experts selected by the court under all the circumstances of privacy and of secrecy (except for the purpose of the giving of testimony by the experts at the trial) that would surround a similar examination by the personal physician of the injured party. Such an examination, conducted for the sole purpose of ascertaining the truth by professional gentlemen of the highest standing, occupying the position of officers of the court, could neither wound the sensibilities of the most acute organism, nor excite alarm on the part of the most suspicious that the examination would be used for

anything but the ascertainment and enforcement of even and exact justice.

The indictment here framed against the present abuses of expert testimony would be confessed by the defender of the existing system, if it had a defender. The remedy for the evil, substantially as I have outlined it, was long ago proposed and has been widely approved. The discussion of the mischief and its remedy furnishes a subjective intellectual pleasure to railway surgeons and lawyers on such occasions as this. But I doubt if practical accomplishment of the needed reform will spring from our discussion. We will be looked upon, I fear, too much in the light of special pleaders, advocating our and our client's advantage. Not that we *are*, but only that we *seem* to be to the prejudiced public interested in the question, except with a lively interest in the accomplishment of both abstract and concrete justice. All that has been said, however, of the use and abuse of expert medical and surgical testimony in personal injury cases, applies with as great or greater force to insanity cases and criminal trials. There the selfish and personal point of view is lost in the higher and broader considerations of public interest; for the abortions which the system there produces are not only crimes against justice but injure the health of the body politic. The ear of the public will eventually be caught by appeals for a change in the prevailing system, based on its evil manifestations in that direction, though our more or less selfish cry be not heard.

DISCUSSION.

Dr. R. Harvey Reed—This paper bears on a subject which, beyond all question, is of vital importance not only to the railway attorney and the railway surgeon, but to the railway com-

pany and the plaintiff. One thought brought out by the paper was that "the expert did not testify to what he knew, but what he thought." That in the abstract may be true—perhaps judging an expert from the standpoint that he is called in to tell what he thinks of certain facts when the facts are presented to him; yet I think you will bear me out that the average expert has knowledge of the facts as well. I know in the courts in Ohio it is a common occurrence for those who have been called to testify as experts to examine the case and then go before the courts and testify as to the facts in the case. For instance, we will suppose a man has prosecuted a company for injury to a limb; that it is short, or it is crooked, and he claims a certain amount of damages because of this. The experts are called to examine him to see how short or how crooked that limb is, how far it is from a normal condition, and to say whether or not this abnormal condition is an injury to that man, and to what extent it is an injury. Under these circumstances the expert is testifying on facts, and he acts as an expert in making an examination of the case to determine for himself what the facts are. Now it seems to me that the expert may not only tell what he thinks, but in many instances he tells what he knows. In the paper it was stated that an expert was called because of his peculiar or particular knowledge; then, if this is so, he must have knowledge or he wouldn't be called; if he has knowledge he speaks from what he knows, and forms his ideas from the facts in the case because he knows them to be facts. I call attention to this because it seems to me from what little experience and observation I have had, that it is hardly fair to say that an expert only tells what he thinks.

If we discard the expert from the witness stand, then who shall give this knowledge? I will admit that as expert testimony is handled by our legal brethren and as expert witnesses act themselves of their own volition, expert testimony in a majority of cases is a farce. But because it has proved to be a farce, is that a reason why we should discard it? We must admit there is a value to be obtained from it if we put it in the right channel—if we handle it in the right manner—and I have for years been a strong advocate of calling the expert witness by neither the prosecution or defense. I think the

moment you put the expert on the stand with the understanding that he is to testify for either the prosecution or the defense, you put him in a false position. He should be called, as the gentleman says in the paper, to testify to the facts and give his knowledge on these facts as they occurred to him and are presented to him. When medical experts are called on the stand it has been the custom of lawyers—and more by some than others—to commence by trying to show that the medical expert does not know anything, that he is a consummate fool, does not even know his anatomy because he could not tell some little muscle about the eye or nose that he would be supposed to know; and the attorneys have frequently made their cases a great deal worse in many instances by resorting to those little technicalities, if you want to call it, or catch-questions as the schoolboys call them, to give the impression that the expert did not know anything at all. That is wrong, and I think the attorneys on either side would take hold of the expert to find out what he knows about the case, place the questions fairly and squarely before him and get out of his head the idea that he is testifying for anybody, but that he is a sworn witness to tell the truth, the whole truth and nothing but the truth as it bears on the question; do not try to aggravate and entangle the witness by getting him off on a subject absolutely extraneous to the question in court, and then endeavor to make the jury believe that what he said is true or is not true, you would find the medical expert would be of more value than he is under the present system.

As to the pay of the expert, I think we are all agreed that he should be paid, but I most heartily agree with the paper that he should be paid and employed by the court. I do not think the prosecution or defense, either one, should employ him or have anything to do with paying him, except they should foot the general bill, which should come through the court entirely, making him a court official, as has been stated. This, I believe, a most valuable suggestion. I think we should advocate the idea—of course it is an embryonic cell and it needs to be developed into to a fixed tissue cell, but it has given us thought that will perhaps help us to remedy this system which has been a detriment to the companies and a detriment to the courts.

Dr. R. S. Harnden—I concede the position which the paper

takes. I believe we are in disrepute today as a profession—I do not think any physician here or elsewhere disputes that fact —but wherein lies the fault? The gentleman points out the remedy. It seems to me that he has simply quoted and reiterated what we ourselves have claimed for many years. I believe it is the voice of the medical profession as well as the legal profession that the expert witness should be employed by the court and paid by the State, so that his evidence should not be biased by the various attorneys. The gentleman has stated that as a matter of fact that might be the case—the attorney might employ the witness and bias his evidence. We all know that to be so. But I want to say in the defense of my profession, that I will not concede any one in the legal profession as being in advance of my own. I believe that while the legal profession is today studying Blackstone and the tenants' law of years since, that our profession is in advance of the current of progress of thought throughout the world. (Applause.) I believe that our's is one hundred years or more in advance of the legal profession, and I say that not to their discredit, but I believe it is true. It seems to me, with our profession standing where it does today, that the courts and the legal profession must be far behind us if they can not obtain help for the procurement of justice from our profession. We have the experience, the ability, we have accomplished great ends in the past decade, and if the judge and the court can not receive the benefit of this improvement then where lies the fault? Now, it is my firm belief that, as able as a judge or a lawyer may be, he may be intensely ignorant on some things. The gentleman presented one point that attracted my attention. I do not remember the terms used, but he would not allow the court or the judge to make the selection, but simply to designate. I think that was a proper discrimination between the two terms, and I think I can state for our profession that we would favor the court's making the selection or designation, but I believe the main point, as has been stated by the gentleman, with some exception, is correct, that the litigant should not pay the expert witness. Now I do not believe that medical experts or medical men, as a rule, are biased to the extent that has been stated. I do not think my profession work for large fees. As a rule they do more for charity and honor than any other pro-

fession on the face of this earth, and it seems to me that it is a stigma upon us for the legal profession to point the finger of scorn at us simply because of their own ignorance and of the methods of obtaining the evidence which shall assist in the procurement of justice.

Dr. A. D. Bevan—The statements as outlined in the paper I believe to be absolute facts. I could not see any attack upon the medical profession. I do not think it was so intended. Certainly expert testimony has been, since I have been a member of the profession and appeared as an expert, a farce. I have almost never testified in a trial without feeling that some of the experts were prostituting, not scientific knowledge, but the name of medicine in appearing in those trials—even men of wide reputation—by being the employed partisans on one side or other of the case. I know that personally I feel and always have felt that when a medico-legal case comes to me, when a man comes to me and is willing to pay fifty or a hundred dollars for my testimony, I can not get away from the fact that I am employed; I can not get away from the effort of making the very best of my employer's side of the case. I feel that and always feel it. I always fight against it and always say to myself, "Now I want to present this case and my opinion of it just as I would in a clinic if it were a medical case and I were describing it in class and not a court room," but the fact does remain that the medical expert testimony as it is today is a disgrace to the medical profession in the better sense of the word, or to medical science in any sense of the word. It is simply one of the evidences of human frailty, of bad machinery in bringing about justice. The same applies to any other profession—an engineer's, a real estate man's expert testimony. The same facts apply to all expert testimony and, as I understand the paper, it is not in any sense an attack upon medical progress or knowledge. It is simply a statement of facts as they are, and I believe them thoroughly stated. The remedy is, of course, the great problem. I think it lies more in the hands of the bench and bar than it does in the hands of the medical profession or any class of experts. I believe that they could start the machinery in motion that would bring about the necessary reforms better than we can, but that the fact does exist we can not get away from. I know that every one

of the members of this Academy have felt when they have testified in various medical cases where some charlatan was introduced and made some absurd statement, that expert testimony was a disgrace to science and justice, and eventually we must find some means of curing this error. I have often thought when I have heard this subject discussed, that someone must start the machinery in motion, some one must make an effort and bring about this reform. The Academy of Railway Surgeons can do very little, but I think we could do something, and whatever we can do I believe we should put ourselves definitely on record as doing. I would not submit a plan, but the end must be accomplished by the education and elevation of public opinion until it demands some definite, positive change in this matter.

Dr. Milton Jay—I do not know of any subject that is more essential or of more interest to the physician than this one. Having been for many years connected with the railways of Chicago, I have been utterly disgusted with the testimony from experts, whether they are posted or not. It is an injury to the cause of railroads that we are surgeons of; it is not one time in ten that the injured individual gets justice, and it is never that the expert gets justice. Now I thoroughly believe what Mr. Mather has said on this subject. You go as an expert, you are the chief of local surgeons of the road and you are one of the experts. Dr. Reed says the lawyer tries to tear their evidence to pieces—the lawyer is not worth a cent if he does not. (Laughter.) What is he there for? How long do you suppose a man sueing for an injury would employ a lawyer if he did not do his best to get all the damages he could? And the very fact that I am a railroad surgeon, although I undertake to tell what I honestly think is that man's condition, and has been, do you suppose a jury takes my evidence to be as honestly given as though it were given by a man outside the employ of the road? The jury can not do it, and the lawyer can make the impression that I am a little bit biased—and if I am not a little bit biased in its favor the railroad is not going to keep me. (Laughter.) I acknowledge that what Dr. Bevan says is absolutely true, and I do not like to go as an expert for my own company, while the companies tell us, as they do, "Tell what you believe is the condition of things, but if you

have to be biased, try to be biased in our favor and get your witnesses to believe the same way." It is human nature and I do not think that is lying. These are the facts of the case. We do not get our dues and the expert does not get his. If he is employed by the plaintiff it is perfectly natural that he is going to help that plaintiff. I have talked within the last six months with the officers of our railroad from the President down, and said: "Can not we get together and get a petition to the legislature to remedy this evil?" Our attorney says, "You can not do that." I asked why. He said, "Because the legislators will say the railroads want it, and they have got to pay for it," and he said, "Good Lord, you would not expect to get anything through the legislature unless there was boodle in it? Have you got a hundred thousand dollars? If you have, I can get anything through." I do not believe we will ever get it by legislation, but if we could get at it in some way, either as Mr. Mather suggests, or in some other way, so that the judges or an association of judges, three or five, in this city should have a staff of disinterested surgeons or physicians, or whatever they might be called, so that out of them the judge should pick one, or two, or three, and that be the only testimony given, that would be disinterested. The point is to get disinterested evidence before the jury. The jury will not consider an employe as impartial as an outsider. I would rather never be an expert than what you have to be under the present circumstances. The Doctor here (Dr. Harnden), thinks he has got the grandest profession in the world, the medical profession. I have found some lawyers pretty well up in anatomy when they come to the cross-examination, and the doctor does not know anything like as much about legal science as the lawyer does about medical science. It is a subject as broad as the surgeon and the railroad and the lawyers that have to do with it, and I say, and have for years, there ought to be some kind of medical evidence, some way or rule adopted by which the medical expert could be disinterested, not employed by either the defendant or prosecution.

Dr. W. A. Ward—I would like to have the gentleman in his closing remarks explain one thing that he broached in his paper. If this expert medical witness is made an officer of the court and these intricate medical problems are submitted for solu

tion, and upon submitting that report, either verbally or in writing, as the court might dictate, I would like to know if he should be subjected to a cross-examination upon it. He simply does in that function, as I understand the idea, what the judge does in his charge to the jury. The judge elucidates, or attempts to elucidate the points of the law. Now let this commission, or whatever may be seen fit to call it, that is appointed from the medical profession elucidate the medical or surgical principles involved, and let that be as sacred as the judge's charge. If it were rightly conducted, and the proper rules employed, it would stand to the jury in the same relative position, or could be brought up to that position.

Dr. D. C. BRYANT—I want to state for the paper that the the gentleman read, that I believe as he does, that the fault lies not alone with the medical or legal profession, but with the law itself. As the law now stands, we, if employed as experts, stand in the same relation to the plaintiff, or the one that employs us, that the lawyer does—the great difference being in the amount of fee received, the lawyer gets the money and we get very little. Out in the wild and wooly west the lawyer saves us from "prostituting our honor" by interviewing us beforehand; first the man who wishes to employ us holds a private interview with us, asking our opinion about the case; if it pleases him then he sends his lawyer the next evening, and the lawyer interviews us, and if we can answer his questions to his liking he employs us as experts; if not, we are turned down, which saves us from "prostituting our honor." I do not know whether this is done in the East or not, but it is done in the West. I do not see any remedy except as suggested by the writer of the paper, that is, changing the law and have the expert employed and paid by the court and not by the parties.

Dr. L. E. LEMEN—There is one way in which this whole thing can be settled satisfactorily, and until that is done it never can be settled satisfactorily, and that is, to have the expert -let him be medical or any other department be an officer of the court the same as the Judge. As long as humanity exists the expert will have a sympathy for the one who calls him; it is utterly impossible to be otherwise. A little further in the West, and perhaps a little woolier than where

Dr. Bryant comes from, in Denver, when an attorney comes to see us as expert in any given case, he gives us a retainer and places the case before us, and if our testimony is such that it can benefit him we go on the stand; if not, he seeks some one whose conscience is more elastic.

Dr. C. B. Kibler—I think it was Holmes who once said, "Strong is the blister that will draw upon the conscience of the man of law." I believe the legal profession is as much at fault in the manner in which the expert medical testimony is looked upon today as is the expert himself. The attorney takes the expert in his hands and he assails him with the questions he has fortified himself with, and makes it appear that the expert does not understand the case; how does he do it? Simply by not allowing that expert to express his honest opinion. The charge can be laid at the door of the legal profession that the expert is such as he is.

Dr. C. K. Cole—The expert does not need to attempt to do this work unless he feels equipped, unless he feels competent. The expert should go upon the stand with the consciousness that he knows more about the subject than any one else, and he should know the law concerning the subject upon which his evidence is given. If he feels that he is not thus competent he should decline to give the testimony. I think we are agreed that the writer of the paper has not undertaken to make an attack upon the medical profession. He has given us some plain truths and, as he himself terms it, his paper constitutes an indictment, an arraignment, and we can but acknowledge the truth in the main of what his paper says. I believe the medical profession has a crystallized sentiment upon this sub ject: we are agreed that our function as medical experts is to be non-partisan, to be absolutely fair, and I believe it is as possible for medical experts to be fair as for the judge on the bench to be impartial in his rulings. Professor Bevan speaks of the better side of the medical profession. There are two sides to the medical profession; the charlatan, the ignorant, who is ready to prostitute his position in the interest of the fee, may be compared to that class of lawyers who today in the butchering business, tomorrow elected justice of the peace and the next day are honored members of the bar; those are the lawyers who may be compared with the ignorant physicians

who are incompetent and unworthy. I believe the solution of this question lies with the bar, with the better side of the legal profession, who must make sentiment for a better state of affairs and possibly carry out the suggestion in the address of the President, of a commission of experts appointed by the court, similar to the commission existing in France, which shall be prepared to give absolutely non-partisan testimony in cases of this character.

Mr. MATHER—Mr. President and gentlemen: I appreciate keenly all that has been said about my paper, and I accept it as heartily and welcome the criticism that has been urged against it. I thing there will never be anything done to rectify the evils of this matter until the conscience of both professions are pricked by the deplorable situation and both impressed with the necessity for impartial expert testimony, and I think it is well both that I should have said some sharp things of the medical profession and as one of you said, that I should be compelled to take the medicine myself. I had supposed that the charge of prostitution that I brought against the medical profession had been so hedged by limitations that it struck those to whom it properly applied. Dr. Reed I think misconceived that portion of my paper in which I said the expert was called to testify to what he thinks and not what he knows. In a legal sense the expert occupies two positions. He is an ordinary witness as to the facts of which he is advised either through examination or treatment of the case; in so far as he testifies to the actual condition he stands on the apparent facts of the case; as for instance, the length of the limb or the extent of its crookedness, he becomes an ordinary witness; he is not an expert in the ordinary sense in which that is used in the courts until he comes to testify to the unseen and hidden things which the eye can not see and which the court, jury and lawyer know nothing about except as they have the opinion of the medical adviser on that point. So that when I said the expert is called to testify what he thinks and not what he knows, I had differentiated those two positions which he occupies. I do not think it is necessary for me to say that no attack on the medical profsssion was intended in my paper. I have already been ably and eloquently defended on that charge. With reference to the suggestion of an official staff of experts,

it has occurred to me there is a great deal of practical difficulty in the way of working out the reform through that means. In Germany, as I understand, there is a complicated system of official experts that work up from the county physician, or what is called county physicians with us, to a sort of court of medical review which passes in the last instance on any medical question. I am hardly prepared to believe that our experiment with republican forms of government has demonstrated the entire feasibility of that sort of system here. I think the medical profession will agree that the character of medical men, the class of medical men either by election or selection of the executive to fill the offices of our public institutions that are required to be filled by gentlemen of your profession, is of such character as to justify any considerable experimentation of that plan. In other words, I believe the influences which surround political selection for public office, either by ballot boxes or appointment of the executive, are such as would not get a high class of public experts, and therefore I am convinced that aside from the suggestion that I have made, that in each case there should be the designation by the court of the experts who should examine into that case and make a report, we ought not to go any further. (Applause.)

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CHAPTER III.—MISCELLANEOUS.

FIRST AID IN RAILWAY EMERGENCIES.

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COLUMBUS BARRACKS, OHIO.

Introduction.—About 9 o'clock in the evening of the 11th of last August, during a blinding thunderstorm, an express train dashed into a small freight train a short distance outside of the passenger station at Columbus. W. N. S., the fireman of the passenger engine, an unusually vigorous man of 38 years of age, was hurled violently down from the cab to the Scioto River, twenty feet below. So tremendous was the force of his ejection from the engine cab that his body was completely torn from his right foot which had been caught in the wreck, leaving a horribly lacerated stump midway between the ankle and the knee, while the soft parts above the latter joint were also severely injured, rupturing the anastomotica magna and giving rise to a considerable hematoma in the thigh. Throughout the accident, this man retained entire self-possession and when found some time after the disaster, he was engaged in tying a portion of his cotton jacket about the injured limb to check the alarming hemorrhage which was occurring from the wound. Unacquainted with the means of properly tightening his

extempore tourniquet, sufficient compression to close the arteries failed to be exerted, and when he arrived at the University Hospital, an hour and a half after the collision, the bleeding from the external wound together with that from the ruptured anastomotica had brought him almost to the point of exsanguination. At the hospital, he was so fortunate as to be admitted to the service of the senior surgeon, my distinguished friend, Dr. R. Harvey Reed—to whose courtesy I am indebted for the privilege of quoting the case—and his colleague Dr. W. U. Cole. The patient's wet clothing was instantly removed, he was wrapped in warmed blankets, hot water bottles were placed about him, and other measures designed to restore the normal temperature and revive the vitality were employed, such as alcoholic stimulants, hypodermics of strychnin and nitroglycerin, and injections of hot saline solution. The hemorrhage was controlled by the elastic ligature, and the limb amputated as quickly as possible at the juncture of the middle and lower thirds of the thigh. Very little anesthetic was needed and very little given. The patient rallied promptly from the anesthesia but, owing to his bloodless condition and the impossibility of correcting it, he gradually became delirious and about an hour before the end experienced a tonic spasm, after which he sank rapidly, expiring about eighteen hours after the accident, a victim of exsanguination.

This accident occurred in the midst of a city of a hundred and fifty thousand inhabitants, containing a hundred and fifty medical practitioners, numerous hospitals, and two medical colleges. There were a dozen physician's offices within five minutes walk of

the locality of the disaster, not to speak of numerous telephones by means of which dozens more might have been quickly summoned to his relief. But he bled to death! Here was a man of mature age and well-regulated mind who, notwithstanding his frightful injuries, was in full possession of all his faculties and anxious to apply for himself the treatment which would stay the approach of the king of terrors. Had he been instructed in the simplest elements of first aid, the application of the simplest form of improvised tourniquet, W. N. S. might today have been about the streets of Columbus with a healthy amputation stump upon which a suitable artificial limb could readily be worn, and the statistics of the skilful surgeon, who attended him, might have been increased by one more success in addition to the large number already enumerated in his case-books.

Railway mortality.—The average number of persons injured yearly in railway accidents during the seven years from 1888 to 1894 was 38,500, of which number 6,500 were killed, and in the year of the Columbian exhibition there were 47,000 casualties of which 7,000 were fatal. For the treatment of these cases numerous magnificent surgical systems have been devised. The surgical staff of so many of our railroads at the present day is so highly organized that to mention one would be an invidious distinction. The statistics of injuries accentuate the need for such organization and it is to the credit of humanity that so many railways have provided for it.

The field for first aid.—There is a period, however, for which most roads have as yet made no provision—the period between the occurrence of the acci-

dent and the arrival of the surgeon. The opinion has been advanced that on some roads the stations are so near together and the local surgeons so readily accessible that this period is inappreciable and does not require to be provided for. Esmarch in his Samariterbriefe has well shown the fallacy of the idea that such provision is required only in sparsely peopled localities, reciting an instance of a fire in the city of Berlin where, after an apparently suffocated person had been brought out of a burning house, it was two hours before a physician could be brought to the spot, the life of the victim being saved only because of a knowledge of first aid upon the part of the firemen. And even in our own case of W. N. S., it was an hour and a half from the avulsion of his leg to the application of the elastic tourniquet in the University Hospital, although the accident occurred within touch of the best possible surgical treatment. There is no question but that everywhere on earth emergencies are liable to occur in which life or death may hang upon the presence of a person with a knowledge of the simple elements of first aid, and no where is this more profoundly true than in the emergencies of railway practice, unless perhaps it be on the battlefield.

Existing first aid arrangements.—In order to ascertain what may have been done in this respect in the railway service, in the course of my study upon the present subject, I addressed to the chief surgeons of fifty prominent railways, a letter containing the following questions:

1. Have you any organized system of rendering first aid in illness or injury aside from your medical staff?

2. What, if, any, of the employes of your road are instructed in first aid?

3. What, in a general way, is the character and scope of the instruction?

4. What advantages have been derived from the instruction?

To these letters I received twenty-nine replies.[1] Of this number five replied in the affirmative, six in the affirmative to the extent of a first aid surgical dressing case with printed instructions for the use of its contents, and eighteen replied wholly in the negative. It is a fair presumption that those who did not reply at all, would also have given a negative answer. It is evident then that but little has been done in the organization of first aid in railway emergencies. Indeed, it would seem that even on the roads on which efforts, looking to the first-aid instruction of the non-surgical employes, have been inaugurated, a complete and definite organization has hardly yet been attained.

Advantages of first aid.—The advantage of first aid in those cases in which life may be saved by the prompt application of temporary assistance is evident, but it is no less a fact that it is of proportionate value

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[1] The gentlemen, who so courteously answered my questions, were: Drs. W. A. Adams, F. W. & D. C. Ry.; F. P. Bancroft, U. P. D. & G. Ry.; C. E. Brayton, N. Y., N. H. & H. Ry.: F. H. Caldwell, Plant System; G. P. Conn, C. & M. Ry.: H. P. Cooper, A. & W. P. Ry.; Walter Courtney, N. P. Ry.; C. M. Daniels, W. N. Y. & P. Ry.; C. M. Drake, Southern Ry.; W. H. Elliott, C. of G. Ry.; W. L. Estes, L. V. Ry.; W. J. Galbraith, U. P. Ry.; A. P. Grinnell, V. C. Ry.; S. S. Halderman, C. P. & V. Ry.; G. H. Hogeboom, A. T. & S. F. Railway.; J. H. Jenne, C. V. Ry.; S. Marks, C. M. & St. P. Ry.; P. H. Millard, C. G. W. Ry.; S. Mitchell, J. T. & K. W. Ry.; R. D. Mussey, C. H. & D. Ry.; J. E. Owens, C. & N. W. Ry.; N. J. Pettijohn, K. C., F. S. & M. Ry.; J. F. Pritchard, M. L. S. & W. Ry.; R. H. Reed, C. S. & H. Ry.; W. B. Rogers, K. C., M. & B. Ry.; Stuart & Boyles, H. & T. C. Ry.; S. S. Thorn, W. & L. E. Ry.; J. F. Valentine, L. I. Ry.; F. B. Tibbals, M. C. Ry.

in less serious cases. The ability to cope with possible injuries inspires men with self-confidence in emergencies. They are not so apt to lose their heads. And yet it can not be denied that even under comparatively favorable circumstances some men will become confused. Instruction in first aid will, however, reduce this to a minimum in accidents.

A knowledge of the subject is valuable, if for no other reason than because it will teach men to avoid improper or dangerous methods of treating emergencies. The use of the tobacco-quid saturated with the indescribable ingredients of the saliva of the habitual tobacco chewer, the cobweb with its collection of filth from all quarters, the sweat-permeated cloth torn from the dirty garment, and perhaps, worst of all, the mucus-laden handkerchief are banished from contact with open wounds. Cleanliness is learned and wounds do not come to the surgeon already infected by filth.

Familiarity with proper methods of handling the injured is of the greatest advantage in four respects: 1. It renders it possible to remove the wounded from wrecks more expeditiously, a feature which may be of vital importance in case, for example, of the not infrequent instance where fire is an accompaniment of an accident. 2. It may be an infinite saving of suffering to the injured. The infliction of pain in moving a patient is an evil so easily corrected that there is but little excuse for not knowing how to do it painlessly. The saving of unnecessary suffering to a patient means diminution of shock and a more favorable condition for the treatment of the surgeon. 3. It prevents the aggravation of injuries so frequently due to

improper handling. A wealthy Englishwoman, in alighting from her carriage, slipped and sustained a simple fracture of the leg. The well-meaning and intelligent enough people, who helped her back into her carriage so that she might return home, had not been taught the way to lift and handle the disabled. That her leg was turned in the attempt and the simple fracture was transformed into a compound fracture, was not so much their fault as the fault of the neglect of the proper instruction of the public in such matters. Were all such cases fully known and recorded, there is not the shadow of a doubt that hundreds of instances of such aggravation of injuries would be found in the history of railway surgery. The prevention of such occurrences may detract a little from the experience of the surgeon, who will certainly receive less credit for the successful treatment of a simple wound than for the cure of a complicated injury, but it will improve his results, simplify his labors, and enable him to accomplish more work in a given time. 4. It is to the pecuniary advantage of the railway company for, (*a*) the fact of thorough preparation having been made for every emergency will give the public increased confidence in the road, which will result in increased patronage, and, (*b*) the diminished severity of injuries due to prompt attention and careful carriage will materially reduce the amount of damages which may have to be paid to the injured.

Hemorrhage is perhaps the complication of railway accidents in which first aid would be more particularly applicable, although it must be admitted that the bleeding is often surprisingly limited, especially

in crushed wounds where the lumina of the injured arteries have been occluded by the compression which caused the accident. Nevertheless bleeding may be placed at the head of the list of complications, the failure to immediately correct which, may convert an otherwise curable injury into a fatal one. A Lieutenant-Colonel in the Army, while fighting at the head of his command, was wounded in the thigh by a band of hostile Indians, sustaining a division of the femoral artery. The surgeon was at the rear of the small command and, while a messenger was despatched for him, some of the line officers endeavored to arrest the bleeding as well as they could, but not being expert in the application of improvised tourniquets, they were not successful in entirely checking it. When the surgeon arrived in a few moments, the patient presented all the evidences of fatal hemorrhage, from which he never rallied. That was before the institution of first-aid instruction in the army. Now, every subaltern and a large proportion of the enlisted force would be competent to step in and apply an extempore tourniquet which would amply control such hemorrhage until the arrival of a surgeon, rarely far away in military service.

But hemorrhage is not the only accident in which prompt action may avert impending death. In cases of submersion under water as may occur in case of a fallen bridge, prompt action is notoriously of advantage. In cases of suffocation by smoke or heat, such as may occur in a railway fire, the prompt application of artificial respiration is equally efficacious. The advantage of prompt treatment even of apparently fatal shock is too well known to demand repetition;

while the prompt and easily-learned treatment of heat stroke may also mean the difference between death and life.

A little acquaintance with the treatment of foreign body in the eye is apt to be of particular service to a railway man, since this accident is probably more liable to occur in his experience than in that of any other class of individuals.

First aid may be applied with advantage in many other less serious surgical incidents. Not only simple wounds, but bruises and sprains may be prevented by prompt and intelligent treatment from developing into serious and disabling injuries. While fractures can not be permanently treated except by the surgeon, their treatment can be greatly assisted by the exercise of proper measures to prevent the aggravation of the injury and to conduce to the ease of the patient. Burns and scalds, on the contrary, when not severe or extensive, may be sufficiently treated by the first-aid man, while colic and diarrhea may often be controlled by the exhibition of simple remedies.

And, as already suggested, not the least advantage to be derived from instruction in first aid in railway emergencies is the obtaining of organized discipline and intelligent conduct in case of accident. Instead of careering like so many decapitated chickens or crowding about the injured like so many bucolics about a prize beef, the men will naturally fall into places where each one can be of the most service and order will readily be brought out of chaos.

So many, indeed, and so forcible are the arguments in favor of the thorough instruction of railway employes in first aid that the discussion might be pro-

longed almost indefinitely. But, admitting the desirability of such knowledge, we naturally fall upon the consideration of the questions, as to what men should be instructed, whether all should receive the same amount of instruction, how the instruction should be given, what facts should be taught, and whether men qualified in first aid should be distinguished by a badge to indicate their training.

Who should be qualified to apply first aid.—As employes who are in command of men may not only be required to apply first aid themselves, but to direct others in rendering assistance, such men as conductors, yardmasters, station agents and foremen of shops should particularly be instructed.

All men connected with passenger trains should be qualified, not only from the standpoint of humanity, because of the relief which they may afford to injured passengers, but from the standpoint of the interest of his railway company, since prompt attention to injured passengers may prevent aggravation of injuries and possibly increased claims for damages.

Both of these classes of men should be taught not only the application of first aid, but should be instructed in the organization of first aid parties in extensive accidents and in the best methods of showing others how to apply it.

All other employes should be taught the subject in a less complete manner perhaps, although in view of the changes which transfers and promotions may make, it would be well enough for them all to receive the same amount of training.

Substance of first aid instruction.—Of what then should the instruction consist? In a recent paper on

"Methods of Instruction in First Aid," I recommended that the instruction of the enlisted men of the army be given in five lectures, each occupying a full hour; it might be of advantage in railway work to add a sixth lecture. The course thus arranged would be as follows:

1. The Human Body—the skeleton and the circulation in particular.
2. Bandages and Dressings—the triangular bandage in particular.
3. Wounds and Bleeding.
4. Broken Bones.
5. Unconsciousness—suffocation and shock in particular.
6. Other Emergencies—including the use of the emergency box.

It is impracticable, in the limited time at our disposal at present, to specify in detail the facts, methods and theories which should be taught. I have endeavored to do this in my little book on First Aid in Illness and Injury,[2] which may be familiar to some of you. It is worth while, however, to go over briefly the subjects that will naturally segregate themselves into groups suitable for treatment in the several lectures.

1. The lecture on the human body should include a simple description of the body, its chief component parts and the principal vital functions carried on by it; a little knowledge of bones and muscles; something about the nervous and digestive systems; more about the respiratory function and the organs involved in it,

[2] "First Aid in Illness and Injury." By James E. Pilcher; fourth edition, 8vo, pp. 322. New York: Charles Scribner's Sons, 1897.

and still more about the circulatory system. Experience has led me to consider this introductory lecture as absolutely essential to a proper comprehension of the practical subjects to be taken up later. It is never safe to presume upon the prior existence of any anatomic or physiologic information whatever. Even the most intelligent laymen often display an amount of ignorance that would be laughable if it were not lamentable, and still less acquaintance with the subject must be expected in the less educated.

2. The second lecture, on bandages and dressings, is also foundation work, and its mechanical characteristics ought especially to appeal to the interest of the mechanically inclined railway employe. The triangular bandage, the basis of all surgical first aid, should be taught in all its uses. It is not sufficient simply to talk about it, but it must be shown in actual use. And even that is not enough, for its application can not be satisfactorily understood until every man has himself applied it in all its various modes of employment. The manner of improvising dressings and some suggestions as to the sources from which they may be extemporized is an essential feature of this lecture.

3. The third lecture, on wounds and bleeding, is the natural sequel of the first two—the practical application of the materials learned in the second upon the parts taught in the first. This is really the most important lecture in the course and may often with advantage be expanded into two, treating in some detail of wounds of various kinds, and in particular, crushed and lacerated wounds; reviewing the circulation of the blood and especially the course of the principal arteries, with the location of the most appropriate points for com-

pression in order to control bleeding; the differentiation of the varieties of hemorrhage and the treatment appropriate to each, including the arrest of arterial bleeding by digital pressure and by the tourniquet, will all come within the scope of this lecture.

4. In the fourth lecture, on broken bones, the nature, character and most frequent location of fractures are to be taught, together with their possible effects on the tissues adjacent to this break. The signs of fracture and cautions against unnecessary handling may be followed by a description of the methods of retaining the parts safely and comfortably until proper surgical attendance may be secured. The improvisation of pads, cushions and other supports should also be considered in detail.

5. The fifth lecture, on unconsciousness, is a most important one in connection with railway emergencies, involving, as it does, the treatment of severe shock and collapse, cerebral concussion and compression of the brain, as well as simple fainting. Suffocation in its various forms, including compression of the chest, drowning and inspiration of hot air or smoke, is most important. If inebriation does not often come under the eye of the railroad man, sunstroke certainly may, and convulsions sometimes do. The use of position, hot and cold applications, the administration of stimulants, the employment or avoidance of friction and the application of artificial respiration should all be well understood.

6. The sixth lecture, on other emergencies, may be a collection of the facts not taken up in the others, such as the removal of foreign bodies, the treatment of the effects of heat and cold—burns, scalds and

frost bite—cramps and diarrhea, and the like. Here may also be taken up the use of the emergency box and its contents.

In connection with each lecture, some method of transporting the disabled should be taught. This proves an excellent relief to the monotony of a long talk and helps not a little in impressing the facts taught upon the minds of the hearers. Moreover, it is so exceedingly important a feature of first aid work, that advantage should be taken of repeated opportunities to impress its methods upon one's auditors.

Methods of instruction.—With regard to methods of instruction, each lecturer will determine the way in which he can himself best impress his audience. In a paper[3] upon this subject in its military relations, read at the last meeting of the Association of Military Surgeons, I arrived at the following conclusions among others: 1. The best method of instruction is a combination of the lecture, the demonstration and recitation from a text-book, neither of these being sufficient without the accompaniment of the other two. 2. The best instruction is characterized by extreme simplicity of diction and the avoidance of all technicality of language. 3. The best instruction is progressive in character, beginning with anatomy and physiology and advancing to bandages and dressings, and then to emergencies proper. 4. The work is advantageously supplemented by home study of a first-aid text-book.

Excellent charts are available for assisting in the graphic presentation of the subject, and they should

[3] Methods of Instruction in First Aid, New York Medical Record, Sept. 5, 1896.

be freely used, but nothing can impress men so strongly as a demonstration upon a human subject, and this plan should be utilized whenever practicable. An excellent method in lecturing upon the circulation before male classes is to demonstrate the course of the arteries and veins by red and blue outlines painted upon the skin of a living man. It is not difficult to find men with sufficient enthusiasm to willingly serve in this capacity, and the subject is rewarded for his self-sacrifice by the especially strong impression which the lesson makes upon himself.

Recitations from a text-book, which are used with great advantage in military first-aid work, are not always practicable among the frequently changing forces of railway work, but I can not too strongly urge the great desirability of encouraging the men to the private perusal of a suitable first-aid book. Every station should be provided with one of these—one of the more complete works—and every train should have one in its emergency box. A most useful place for such a work would be in the drawing-room car together with the hotel directory and the railway guide. But, more than that, each employe should be advised and encouraged to provide himself with proper literature upon the subject and, in the light of the lectures and demonstrations of the surgeons, he should study it carefully and conscientiously. This plan is followed with success in numbers of the National Guard organizations, where every member is required to provide himself with a first-aid text-book and to make it the subject of home study. Information received *viva voce*, as in lecturing, is easily forgotten and demands reinforcement by subsequent reading.

The emergency box.—While every man should be taught to extemporize dressings from any available source, it must not be forgotten that better results may be obtained by the use of properly prepared dressings. This is what contributes value to the emergency chest. Every ambulance association has devised one and not a few have been constructed by railway surgeons. I am inclined to think that the chief defect in these chests has been that too much has been left to the judgment of the railway employes. Such a box should not be stocked with a supply of bandages, a package of gauze, some antiseptic tablets and a paper of pins, each article by itself, to be combined as needed for accidents. In order to get at the articles which they need the first-aid men will handle over the lot with their travel-stained hands, until in a short time the entire chest is too filthy to be used. A plan which avoids all this and which also saves the layman the responsibility of grouping the proper articles, is the collection of all dressings into the form of first-aid packets. These packets may well be an extension of the military first-aid dressing packet. The form commonly used in the army was devised by Esmarch of Kiel and contains in a small space: 1, two compresses of sublimated gauze, each wrapped separately in oiled paper; 2, one roller bandage two yards long, of sublimated cambric with safety pin, and 3, an illustrated triangular bandage. One of these packets contains dressings ample for wounds of considerable size, and for very extensive ones two or even three may readily be employed. In addition to wound dressings, the box might with advantage contain a few simple remedies, put up in tablet form when practicable, and

with exact dosage; diarrhea tablets, colic tablets, anodyne tablets and, in a bottle of colored glass studded with points to prevent confusion, a number of antiseptic tablets for making solutions for wound cleansing. A bottle of aromatic spirits of ammonia, some packages of bicarbonate of soda for burns, and a few light and small splints might be introduced with advantage; a pair of shears and of dressing forceps should not be omitted and a good first-aid book should always be added. Such an emergency box should form a part of the outfit of every conductor, station agent and foreman, who should be thoroughly instructed in its use and held strictly responsible for its availability and serviceability at all times.

Uniformity in first aid.—The course of instruction given should, as far as possible, be uniform for each road; indeed it would be better still if a uniform plan were adopted for all roads. Men transferred from point to point, or exchanged from road to road would not then be confused by varying instructions and, wherever they might be, they would naturally fall into suitable first-aid positions. Absolute uniformity, of course, would not be sought for—opportunity must be left for the individuality of the teacher—but the desired result would be obtained by the adoption of a uniform syllabus of instruction.

Frequency of instruction.—The course of lectures should be given by each surgeon at least once a year to the men connected with his section of the railroad. On account of the constant change in the *personnel* of the employes, a not inconsiderable proportion of his hearers will be new each year and in any event no one can fail to be benefited by one or two repetitions of

such instruction, particularly at annual intervals.

Rewards for proficiency.—The St. John Ambulance Association of England and other societies for the propagation of first aid hold examinations upon the subjects taught in their classes and issue diplomas and medals to those who pass. It is worthy of consideration whether a similar plan might not be of advantage in the railway service. If those men who had been found qualified were decorated with a red cross, to be worn in a conspicuous place, it would render them more easily discernible in case of accident and the possibility of winning the decoration might add a little to the general interest in the subject.

Conclusion.—The results of such organization, if thoroughly applied, will be surprising. In the accident in which W. N. S. made so gallant a fight against impending death, only two other persons were fatally injured. I am not so presumptuous as to assume that the percentage of cases, fatal without first aid, would be present in every railway accident, and assert that one-third of the deaths might be avoided by the proper administration of first aid, but I am prepared to assert, and that with the positiveness bred of actual knowledge, that by the faithful employment of first aid in railway emergencies a distinct improvement in the result of the treatment of railway injuries may be obtained, a material reduction in the mortality of railway accidents may be achieved, and an unspeakable amount of suffering may be saved to the unfortunate victims of future railway disasters. Simple in organization, inexpensive in application, easy in accomplishment, the results will be out of all proportion to the cost. The general adoption of first-

aid, then, will not only benefit both the railway service and the traveling public, but it will be a distinct ethical advance introducing into railway work an era of realized responsibility, elevated humanity and genuine altruism.

DISCUSSION.

Dr. HENRY HATCH (Quincy, Ill.)—I was very much pleased with the paper just read and it coincided with my ideas, as I have claimed to be the first surgeon who has put emergency boxes up for a railroad at his own expense. I have devised some emergency boxes of my own which I have in use at the prominent offices in Quincy station; I put up seven of them. In the box I have adhesive plaster, carbonated gauze and absorbent cotton. I have the absorbent cotton put in separate bandages, and the gauze put in a jar, each containing about one-eighth of a yard. The adhesive plaster is put in tin boxes in little coils; in this connection, I have a little stick which I give instructions how to use as a torsion key, and in the cover of the box are printed instructions how to use this material. To the head of every one of the offices where the box is placed, I have taken pains to give special instructions. So far as the boxes are concerned on my part, they are original with me; I never had seen and did not know of any. It has had an excellent moral effect upon the men; while they do not know who put them in, they feel better toward the railroad—the C. B. & Q. They feel as though the railroad company had some heart and is looking to their interest. The C. B. & Q. also has a relief system, whereby the men are entitled to surgical relief free by paying their monthly stipend to the relief association. While I have not had these boxes in but, I think, five months, it has been a saving to the relief department, because a great many of the smaller accidents have been attended to by the men themselves; and for that reason it would be a financial advantage to all railway companies to have these emergency boxes at every station and at every point in that station where there are liable to be accidents. I have one in the freight house, passenger depot, one in the switch office and round house, where they keep the engines. It is my intention to be at Galesburg soon to see the officials and try to induce them to

put boxes along the line. I have sent one to Galesburg and one is up at the master mechanic's office. I am exceedingly pleased with this paper.

Dr. REED—In reference to the paper, which was an admirable one on the subject treated, and which has given us considerable material for thought, I wish to say that when I was appointed surgeon of the Pennsylvania Company some twelve or fourteen years ago, I found on the Pittsburg, Fort Wayne and Chicago Railway some old boxes scatterd here and there, on engines, cabooses, stations and about the road. They were small tin boxes and contained some bandages, cotton I believe, and a few instruments, I do not remember just what they were, perhaps a pair of scissors, something of that kind; very few were complete, and the general superintendent, Mr. Thomas, called my attention to the matter and made the remark that they had been placed on the road years before that and the road was well supplied with them, but owing to the fact that no instructions had been given the men or given those in charge of the men, the boxes had fallen into disuse; when a man would hurt his finger, hand or arm, he would go to the box, pull out a piece of this material and bind up the wound, and close the box; perhaps when something more serious occurred that required the material, it was not there. That was one objection. Another objection was that under these circumstances they did not know how to use it—this was before the days of antiseptic surgery and dressing of an aseptic character—and as there was no one to keep the boxes replenished and no one to report when they were used, the boxes fell into disuse. But notwithstanding that fact, if this matter is taken up properly by the railroads, and proper parties instructed in the use of the material which should be placed and kept in them, I think that something very valuable can be developed out of it. Whether or not we can use all the suggestions made by the writer of the paper in practical work is a question. Those of us who have had some practical experience in this line on railways know that it is quite a task to instruct the employes in many things which we would be obliged to teach if it were carried out in full. For example, I was called on by the superintendent on the Northern Pacific Railroad, who had known me some years ago when he was on

the B. & O., and asked to write out a few simple rules which would govern the men in an emergency, and he emphasized the fact that the rules should be so short and simple that they could be either remembered or read in a moment, and he suggested: If you make the rules explicit, if the men do read them they will not remember, and if they want to apply the rules under an emergency they will not take the time to read them. That was the practical difficulty. I also had a letter from a gentleman from one of the roads in California who had written to me, and it was strange that those two men should have written to me on the very same subject. Again, on the Pennsylvania road I was requested by Mr. Thomas to prepare rules, and the same thing occurred again; three practical men wanted rules, but insisted that they should be short and readily applied, without going into details. And the question comes whether or not we would be able to get the employes to read a long list of instructions and be able to retain them so as to apply them. The plan is certainly an admirable one, and contains a great deal that I think we should consider, but I think it will require some practical work to bring it into full development.

Dr. Smith (Streator)—I have had the pleasure of listening to the very good paper by Dr. Pilcher, also the pleasure of reading his book; I believe it would be beneficial to every chief and local surgeon to get Captain Pilcher's book and read it; I do not know any way that he could employ his time better. He gives some practical ideas and instructions. So far as this box is concerned it is a pretty good thing, but I think very poor without instructions; the first thing you know when a man has an accident he goes and tears off a bandage and puts on a chew of tobacco and lets it go for six or seven days, and then comes to the doctor, and you have a poisoned wound, may be syphilitic, and without instructions I do not believe the box amounts to much. Dr. Wood—I believe he organized the first surgical association on the Wabash—had these boxes, had printed instructions in the lid, and I do not suppose you can find one on the road. The Santa Fe, when they started up, had emergency boxes in every passenger and freight car, and when Dr. ——— took charge of the road I succeeded in getting two of them for Streator. I wish the gentlemen would

see Captain Pilcher's book and read it; it is a very good one.

Dr. McCurdy (Pittsburg)—In order that we may have the benefit of all the best knowledge, I think the best thing that can be done by the Association at this time is to see that copies of this paper reach every manager of every road in our country. In that way it will be able to do some good. As railway surgeons we know that everything that Captain Pilcher has said is of great importance and for him to prepare this paper as exhaustively as he has without having that paper reach the roads and bring some practical results would be a great pity; and I move you that this matter be referred to the executive committee with power to take this action.

Motion seconded by Dr. Reed and carried.

Dr. Harnden—I have listened to the paper with a great deal of interest. I suppose the author is competent to give a good paper and good advice on this subject, and there is no doubt but what theoretical advice is excellent, and if it could be carried out as he has indicated so ably it would be attended with good results. But in my experience in such matters I have found instructions to employes leave them somewhat in the position of a half educated doctor—they kill more than they cure. In giving instructions to employes, especially as to the application of ligatures applied with the idea of controlling hemorrhage; I think nine times out of ten the hemorrhage will be increased for the relief is not intelligently applied. A method of teaching employes might be carried out so thoroughly and exhaustively as to render them capable to fulfil these instructions, but unless you append to a law a penalty you will not make it effective, and unless you append to these instructions some requirement under the head of organized relief association, or on the part of the management of the company requiring such employes to show by answers to questions or by oral examination that he has learned those instructions and remembered them and has some idea of carrying them out practically, then the instructions will not have accomplished much. I think about as amusing an instance illustrating the value of such instructions, a man came into my office one day and said a man was injured in the arm and there was considerable hemorrhage attending it; I went to him, and found both limbs above the knees wound tightly

with cords, I asked what that was for, and one of the boys said he had heard that if you shut off the arteries in the limbs it would prevent hemorrhage in the rest of the body. That is about the way they would carry out instructions. And the recommendation of this same form was brought before the Erie Railway surgeons and it was discussed and it was decided to place the matter in the hands of a committee to formulate instructions and recommendations to the manager of the company. The committee reported at the next meeting with a majority and minority report; the minority report was a long detailed list of recommendations and instructions to the employes and the majority report was a very brief one and consisted simply of some of the most simple forms of instructions; in case of hemorrhage elevate the extremities, which, as we all know would in a large majority of cases of ordinary hemorrhage, control it; this was one of the instructions, another was to place a clean towel or other clean bandage of some kind immediately over the wound and apply compression and run for the doctor, and I think that was about the extent of the instructions—they were very simple indeed. They were presented to the company and immediately adopted and circulated and placed in all offices and given to the employes. Now, I think our Fellow, Dr. Estes, chief surgeon of the Lehigh Valley system, by personal supervision of it, has been able to carry out some method of controlling hemorrhage by ligation, by which he has been able to accomplish some wonderful results. And I say Dr. Pilcher's ideas are most admirable if they can be carried out by personal supervision on the part of the head of the management or the relief department.

Dr. Gardner—I have listened to the paper with a great deal of interest. In our own line [Southern Pacific] we have had boxes some time. The boxes alluded to that we have had on our line (with the exception of the passenger train from San Francisco to New Orleans, the limited, on that a box is placed in the dining car) were ordinarily only a few boxes placed along but they were failures; the contents were mistreated and when they were wanted they were not to be had. The emergency bandage is just the same as the army bandage, but we added the cotton. With that I have printed instructions with every package; these we have placed in the round house, the ma-

chine house and every caboose; in every caboose a dozen bandages and printed instructions in every box. We found it was impossible to give instructions to our employes because our road is far west and the employes change often and we do not have the different employes long enough to instruct them; I made an application for a thousand bandages and they were distributed to the different departments and gave great satisfaction; our instructions are simple and very short so anyone can adapt them.

Dr. REED—I beg the pardon of the Academy and ask permission to add one remark I intended to make and forgot. I wish to say Dr. Pilcher's book should be in the hands of every railroad surgeon, but what I intended to convey in my remarks is I think it will do better work in the hands of the surgeon than in the hands of the average employe. The instructions to the average employe should be short and concise, and be backed by intelligent instruction to the average surgeon, who is fully as ignorant as to what should be done in an emergency many times as the avorage man.

Dr. PILCHER—It has given me very great pleasure to learn from this discussion that the Academy is so nearly unanimously in favor of the extension of first aid work in the railway service. The remarks, however, of the gentleman who seems to doubt its practicability, remind me of the not entirely unknown anecdote of the peripatetic old chap who was wandering about Southern Europe some four hundred years ago circulating a rumor that the world was round. Nobody believed him. But those of us who visited Chicago three years ago can say most emphatically that he was right. The fact that any particular individual had not seen it to be round did not make the world any less spherical. And the fact that some gentlemen, who have not made the effort, think that first-aid instruction will not be a complete success does not in any way militate against the fact that success in railway first-aid is not only a possibility but and actual living fact. Five roads have already used it to some extent, and the chief surgeon of the Lehigh Valley Railway, Dr. W. L. Estes, writes me that upon his road, first aid has saved no less than seventy-five lives which would other-
been lost. These facts alone would seem to amply
that the doubts expressed by the skeptical gentle-

man are an unwarranted reflection not only upon the teaching capacity of railway surgeons but upon the intelligence of the vast body of railway men, many of whom are daily entrusted with matters requiring exceptionally keen judgment and comprehension, and all of whom are necessarily above the average grade of intelligence. Neither the public nor the railway service will tolerate such a reflection for a moment. First aid is not a theory nor an untried practice but it is a thoroughly proven instrument, the value of which has been amply demonstrated not only in railway work, but to a far greater extent in military and in civil life. No flag is so much honored today in the civilized world as the white field bearing a red cross, the symbol of aid to the injured and afflicted.

The point that has been suggested with regard to the possible danger of mistaking the inadequate information acquired through first-aid instruction for a complete medical education is a matter that every first-aid instructor should look after himself. In the little book of which some of the gentlemen have spoken so kindly, I have endeavored on nearly every page relating to treatment to call attention to the fact that the aid rendered is only temporary and pending the arrival of a medical man, who should be summoned at the earliest possible moment. I have too much confidence in the ability of our railway surgeons to have any doubt as to whether or not they will impress upon their men the fact that, except in the very simple cases, their assistance should attempt only to tide over the time until a surgeon can be secured. With regard to the emergency box of which so much has been said, I believe it to be an important feature of railway first aid, although it would hardly seem to deserve the prominence which has been thrust upon it in this discussion. The instructions in the emergency box are also important. No emergency box should be without its instructions, clearly printed and conspicuously placed, nor should it be without a copy of a good first aid book, for the further information of its custodian at his leisure, not for hurried consultation in the face of the emergency. You all remember the peculiar cerebral condition which often takes hold of men in emergencies, and manifests itself either in amaurosis or paralysis of the center of comprehension, so that they can not grasp the meaning of any sort of printed matter. But the

previous instruction in first aid not only enables men to apply the necessary treatment in the majority of cases without reading the printed rules, but in case they may desire to refresh their memories before applying first aid, it gives them the self-confidence which would enable them to go over the rule intelligently and profitably. But the preliminary teaching is indispensable! It is hardly necessary to repeat what I have already stated in my paper, that an emergency box gotten up after the plan described will do away with the objections already made to these first-aid helps, and the plan of issuing the boxes to certain individuals, who should be held responsible for their serviceability entirely obviates the difficulty arising from their becoming damaged or defective.

Some of the gentlemen have referred to the fact that the introduction of first aid into the railway service will require work. There is no doubt of that, it will require work, both upon the part of the railway surgeons and on the side of the other employes. It will require some expenditure also upon the part of the railway companies, but this will be more than counterbalanced by the amount of expensive litigation that will be avoided. Personally, I have no direct interest in the matter except that of a more or less frequent traveler who may on some occasion be in a position to be greatly helped by first aid. I speak in the interests of the thousands of injured persons who might every year be helped by the adoption of systematic first aid in railway work. If, as a consequence of the increased confidence of the people, the receipts of the railways are increased I do not object. If, because of the diminished amount of litigation, the expenditures of the railways are diminished I should be pleased. But these are mere trifles, hardly to be mentioned in comparison with the enormous benefit to the great traveling public, which will accrue from the adoption of a system of first aid such as has been urged.

PAST AND PRESENT OBSTACLES TO THE RADICAL CURE OF HERNIA, WITH DEMONSTRATIONS.

BY PROF. E. WYLLYS ANDREWS, M.D.
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CHICAGO.

Foremost among the obstacles which formerly stood in the way of success with radical cure of hernia was sepsis. This was no more true of hernia than of other abdominal work, but in the days now past when all wounds suppurated in the course of healing and when it was rightly thought that opening into the peritoneum was almost a sin, hernia work could not and did not prosper.

Directly dependant upon this obstacle of sepsis (including septic peritonitis) was that of timidity or conservatism, which acted as a blight upon the best surgeons up to about the time of Macewen's method. This tended in two ways to prevent progress: 1, by limiting the extent of the work, thus promoting half measures; 2, by leading many authorities to condemn radical-cure work altogether.

A third obstacle to success by operators of the past has been the extreme multiplicity of operations proposed and the complicated nature of many of them. It is hardly profitable to dwell upon obsolete methods but I have only to remind you of the names of Cooper, Gerdy, Wood, Heaton, Warren, Ball, Nussbaum,

Barker, Sewell, Russell, Czerny, Macewen, McBurney, Woelfler, O'Hara, Lucas-Championnière and ask how many of us can even remember the multitude of methods these names stand for. You may turn over old treatises and scarcely come to the end of radical cure methods you will find. Through them all runs the perverted idea of trying to avoid the simple and essential feature of the modern method, namely, laying open the hernial canal. There were subcutaneous sutures with or without invaginating the scrotum. There were operations for "sewing the pillars." There were ingenious transplantations of muscles, fascia, bone plates and sponge grafts to plug up the canal. There were injections of irritants and astringents which as you know had an extensive use at one time and are still exploited. There were numerous forms of lacing and narrowing the canal by sutures passed in from without.

What has become of them all? They have been abandoned the world over because of their danger or inefficiency. The crux of radical-cure work is in the question of recurrence. Hitherto the rise and decadence of hernia cures have been like morning and evening of the same day. Of the scores of ingenious operations in the pre-antiseptic era not one, even the most rational, but was followed by such a train of relapses as soon to bring it into discredit. It will suprise any one, who will take time to look over the standard treatises of only five or ten years ago, to find how distrustful the best surgeons were of all radical-cure work. The conscientious writer could but admit that the numerous relapses and the occasional deaths made the operation hardly advisable. This feeling

of distrust was intensified by the fact that many of the methods which failed so signally had been widely heralded in the beginning as infallible.

With the improvements of Macewen and Bassini began a new era. The "open method," the key to success was introduced. Although I think the Bassini method superior to Macewen's, it is fair to give Macewen credit for the central idea, that of dealing directly with the internal abdominal ring. We must not omit to mention that our own Dr. Henry O. Marcy claims to have used essentially the same method some years before either the Scotchman or the Paduan. In inguinal hernia there is but one strategic point, the internal abdominal ring. If this be reconstructed everything else below that point can be ignored. No operator would attempt to obliterate a scrotal sac as a means of preventing return of a scrotal hernia, any more than he would put a bandage around the scrotum instead of a truss above. It is just as irrational to attempt the closure of the external ring or whole inguinal canal while neglecting the internal ring, which is the only practicable point of preventing the return of the hernia.

Now the modern operations, while they are immeasurably superior to the old, also have some obstacles, and as many of you know I have tried to avoid these by a new operation, the imbrication method, which a number of other American surgeons have used with satisfaction.

Among these may be mentioned Dr. L. L. McArthur, Dr. Jas. Burry, Dr. L. Greensfelder and Dr. Bailey of Chicago, some of whom report that they have adopted it after extensively using other methods. Dr. Cole of

Montana (five cases) and a number of my professional friends at various places have kindly informed me of their success with it.

Dr. Wm. J. Mayo of Rochester, Minn., has had a large and successful series of herniotomies. He informs me that he uses the imbrication method in large hernias but continues to employ Bassini's operation for those having moderate or small-sized rings. This is in accordance with my own experience, the need of something to supplement Bassini's method having been found very apparent in certain hernias.

I have preferred in my own work to adopt the new method in every case, as it adds no complexity and certainly gives greater security, but I must admit that Bassini's operation in the favorable cases with small rings gives excellent satisfaction also.

To select my method for the bad cases is at once a high compliment and a severe test of merit, too severe, in fact, to be fair, unless cases be classified in making up statistics.

Having stated that even modern operations encountered obstacles, I am prepared to sustain the proposition by reference to nearly two hundred herniotomies which I have made mostly within the past six years by every method now at all recognized.

Kocher's method ("Verlagerung's Methode," I, II and III) in spite of the eminence of its author, seems to me a step backward, in that it is not an open dissection of the canal. The twisted or sharply flexed neck of the sac drawn outside the external oblique can not but form a funnel or dimple on the peritoneum. The suturing of the aponeuroses is inefficient, blind and endangers the cord in any but the most

expert hands. Furthermore the retraction of the sac by the forceps is not practicable except in cases which pass through the external ring, and not always in them. I have seen many sacs, large and small, which never could have been so treated. It is not possible to determine beforehand whether this is true or not. We have, therefore, in Kocher's operation a method which may or may not be applicable to any given case and we may be forced to change our plan after beginning the operation.

O'Hara's operation is somewhat like Kocher's, with certain steps left out.

Macewen's operation, with its pad of folded sac, is in my judgment easily overestimated. That the sutured and puckered sac really unites into a solid mass in all cases I know of no way of proving. That serous exudate and adhesions gradually give way we do know to be a fact. Nevertheless I have sometimes used the Macewen sac treatment in connection with Bassini's and my own operations in preference to cutting it off. We should be careful not to place too much reliance upon the treatment of the sac as a step in radical cure. The sac is a result, not a cause of the hernial protrusion, and its removal is an incidental not a decisive factor in its cure. If the aponeurotic walls are left weak a new sac will have no trouble in forming, whatever has been done with the old one.

Macewen's suture closing the whole thickness of the abdominal wall into one mass destroys obliquity of the inguiual canal and the natural valvular arrangement. The same thing is true of Halsted's modification of Bassini's operation. With this last admirable operation fewer obstacles are met and its popularity

in America, which seems to have exceeded that in Europe, is, in my judgment, well deserved.

As you know, Bassini's essential improvement consists in a careful suturing of the posterior wall of the inguinal canal, so as to reconstruct the internal abdominal ring. To do this it is necessary to split open the canal, to draw aside the cord temporarily and to get rid of the sac permanently.

The suturing of the posterior wall of the canal is a species of plastic operation. It restores the length and obliquity of the canal and contracts the internal ring so that it will transmit the cord, and only the cord, from within outward. The hernia can not now descend because it is stopped at its very point of exit. If it had been stopped at some other point—say in the canal or at the external ring—it would sooner or later make a way in the looser tissues around the obstruction and reappear to the discredit of surgery. Herein lay the weakness of the older methods. They did not go to the strategic point, the internal ring. The external oblique aponeurosis is sutured by Bassini over the reconstructed canal *edge to edge.* This is entirely changed in my operation as will be seen. [The writer, with Dr. Allport's assistance, here demonstrated upon the cadaver the complete Bassini operation and followed this by performing on the opposite side his own or the imbrication operation.]

Now as my subject is "Obstacles," permit me to refer to some drawbacks even to the success of the Bassini operation just seen. As certainly as you do a number of these operations you will come upon cases where its execution is difficult. These are cases of large internal ring with corresponding defect or

absence of the posterior wall of the canal. They are not always large hernias, but sometimes the defect is so great that no muscular nor tendinous tissue appears between the ring and the rectus border. Now the repair of the posterior wall becomes difficult because it involves suturing into apposition structures wide apart. It is well enough to place one or two of the lower stitches into Poupart's ligament and the rectus sheath, but when these tissues must be depended upon too largely to repair the posterior wall the result is very unsatisfactory.

The obvious remedy for such a defect is the use of a flap from some neighboring part to fill this gap.

It seems to have occurred to several operators to attempt this in various ways. Flaps formed of fascia lata and even of a portion of the thigh muscles, such as the tensor vaginæ femoris, have been suggested. Woelfler advocated the use of the anterior sheath of the rectus muscle turned outward and sutured into the ring and posterior wall. The problem is to rebuild this deficient wall with a flap of some analogous tissue, which can be brought into position with ease and certainty without additional dissection or damage to other parts. To this end I use the structure nearest at hand, the *upper* segment of the divided external oblique, sliding it gently from its former position in front of the cord to a corresponding one behind it. Observe that its fibers are not changed in direction or even separated from the muscle behind. It is simply incorporated *with* the material Bassini uses in the posterior flap. I can not insist too strongly on the importance of using all the conjoined tendon and transversalis fascia present as part of this flap, since

some operators have seemed to think it only necessary to include the layer of aponeurosis of the external oblique. This may be a kind of "imbrication" but it is not my method. Here I desire to call attention to the smooth firm appearance which the canal presents with this new structure incorporated. Of its strength and its unimpaired nutrition there can be no question. The question first suggested on seeing this step in the technique, is whether perhaps we have put the parts under too great tension (see Coley & Bull, Sajous' Annual, 1896, Vol. III). The fact is that there is never great tension here as shown by the ease with which these deep sutures are drawn. The overlapping is only 2 or 3 cm. Is it not true that in a dilated canal the anterior wall is stretched, and that, by thus disposing of the upper flap, we simply make the tension equal in front and behind the cord? Consider, also, how much firmer the union must be between overlapping surfaces than between those united edge to edge as by Bassini.

The *lower* flap of external oblique aponeurosis now remains as a covering to the cord, and is gently laid and sutured overlapping the upper with the cord between them. It is perfectly obvious to you that we now have the same anterior wall as before to the inguinal canal, namely, this aponeurosis. The external ring is also restored as before or perhaps a little smaller. Into the posterior wall, however, is introduced a new and strong layer. Three layers now occupy the place of two and are so interwoven that they support each other and the tension is equally shared by the two lines of suture. I attach some importance to this point as I have found that in the

Bassini method the deep row bears all the stress, and the edge to edge union of the aponeurosis over the cord is not always perfect.

I can not refrain from stating that I have found the principle of imbrication applicable to other purposes such as uniting abdominal wounds after ordinary celiotomy near the linea alba and linea semilunaris; but in this part of the subject I can not hope to interest you at the present time.

DISCUSSION.

Dr. COLE—I had the pleasure about a year ago of witnessing a demonstration of this operation by Dr. Andrews upon a living subject, and since then have had an opportunity to make the operation in five cases, and while that comparatively does not amount to very much, yet I wish to say the operation is to my mind an ingenious improvement upon the Bassini operation and one that will prove satisfactory. Before seeing Dr. Andrews I was prejudiced in favor of the Kocher operation; in suitable cases I still think it is an admirable operation, but I do not think it is so well suited to the average case presented as the practical modification and improvement by Dr. Andrews. You all know what the feature of the Kocher operation is, putting the sac through the upper torsion and making a new operation. I think I have done the operation in three or four cases.

Dr. MAYO—I wish to thank Dr. Andrews for his very clear demonstration of his method of operating for the radical cure of inguinal hernia. He is to be especially congratulated that he has wasted so little time on the peritoneal sac. In the past the treatment of the sac has been altogether too much insisted upon. The peritoneum and skin are the coverings of a hernia and neither has any particular retentive strength. Dr. Andrews wisely shows this in a negative way by dealing almost entirely with the muscles and aponeurosis. The proper restoration of these structures settles the question of radical cure. The sac may be cut off, or as done by Macewen, puckered up about the internal ring; it matters little so long as it is not allowed to evert between the important muscular and aponeurotic structures and prevent their firm union. Like the sac,

the skin has no retentive power and is important mainly from the fact that it can only by great difficulty be rendered reliably sterile, and as suppuration is one of the most common causes of failure by introducing relatively weak scar tissue in the place of structural union of tissues, the greatest care in dealing aseptically with the skin is absolutely necessary. Dr. Andrews' method of placing the sutures is a good idea, for in case suppuration should take place the deeper parts of the wound might escape. Greig Smith long ago pointed out that scar tissue is essentially the same between different tissues and always unreliable and that it should be covered by normal structures if possible. Bassini's operation does this most admirably, the line of sutures of Poupart's ligament being protected by the over-lying flap of the external, and the sutures in the external oblique being protected underneath by the deeper tissues pulled under by the previous line of sutures. But when the space of the internal ring is large the traction necessary to bring the conjoined tendon to Poupart's ligament at the lower angle is great and the union endangered by cutting of the sutures. It is to this class of large hernias it seems to me Dr. Andrews' operation can be beautifully applied: it readily protects this weak point by the strong external oblique fascia which is drawn under in his method. Halsted's operation is one which depends on scar tissue union in one line from within out and succeeds only by leaving in permanent silver wire sutures which act as an internal truss. I have done the Halsted operation a number of times with good success. The Kocher operation is defective in drawing the relatively weak sac between the muscles. After an operative experience of 125 cases of radical cure I had come to the conclusion that the Bassini was the most rational operation and I now practice it almost exclusively. Dr. Andrews' modification of the Bassini in the large hernias, where the defect in the abdominal wall is considerable, will be of great value.

A MEMBER—I am very glad indeed to have had this very clear description: it seems to me to be one of the best operations I have ever seen. I never have had much experience—in all probably thirty cases—but on the majority I did the Halsted operation, except in introducing the stitches I devised a little scheme of my own. I used altogether the heavy com-

mon gut but instead of inserting the sutures in the same manner as Halsted does on the side, I insert the suture on the top about a third of an inch and draw it out again on top, so instead of the edges coming in contact, the edges were turned into the canal; so you have an edge turned down and that seems to me to abate the tendency to a new hernia forming in the new ring, as in the Halsted operation, because in this method of inserting stitches you have instead no raw bulging edges. This edge where it is carried on the upper ring projects downward, and that downward projection interferes with the proper union and a new hernia is formed. My greatest difficulty is to draw it tight enough to be safe and at the same time to prevent strangulation of the cord. My cases have rarely recurred; the oldest, I think, is a little over six years old; most of them have been in the hospital and I have seen very little of them afterward; some of them I have traced two years, but I have heard of but one or two out of twenty of that method that have lapsed. One case I have had under observation continuously; I was an attendant in the hospital at that time; he had a very large hernia which had troubled him for twenty or thirty years. In this case my upper suture above the cord gave way, causing a protrusion; as soon as I discovered that I opened it and trimmed the edges and inserted a new suture, and that is six months ago and it is very good yet.

Dr. Andrews—Of course I am gratified to hear of Dr. Cole's favorable report of cases done by my method. I had the pleasure of meeting Drs. Cole and Galbraith a year ago and showing them my operation, but to hear that this method has been introduced as far as Montana is a surprise. The Kocher operation, like others which depend upon the sac, only seems to me a step backward. Sac adhesions are untrustworthy to retain a hernia. Farther, can any diagnostician tell us whether or not he has congenital hernia before operating? How can Kocher's method be used without a separable sac?

As to the sac, it does not make any vital difference what you do with it. You know the operation of O'Hara consists of cutting off the neck of the sac and retracting the stump, without, however, the deep sutures of Kocher. He leaves the scrotal part of the sac in the scrotum and no harm results in most cases. In a few cases I have dealt with the sac by push-

it back entire. This was when one was found having no distinct neck. Of course a majority of cases have so well-defined a sac that it is easy to strip it gently from its bed and ligate it off. I was particularly pleased with Dr. Mayo's remarks on the sac question. We must not put dependence upon peritoneal tissue for permanent repair, but upon careful reconstruction of the aponeurotic walls. I stand firmly on this principle as embodied in Bassini's and my own method, and distrust the type of operations depending upon sac closure or adhesions. In case of a very large cord or any veins, I do not advocate removing any of them; I always leave two fair-sized veins on the cord and I think one needs to take special pains to avoid the artery; it is not difficult as it is large, and if you get your artery mixed in with the sutures I think it would most certainly cause gangrene of the testicle.

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THE MEDICO-LEGAL ASPECT OF FLOATING KIDNEY.

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The rarity of a condition makes it all the more important from a medico-legal standpoint. Cases of frequent occurrence give greater opportunity for their study and consideration. Rare cases offer few precedents and afford but occasional opportunities for observation.

Less than a year ago, I was called to testify as an expert witness in one of these rare cases, which, so far as I am able to learn, has never had a precedent, but its importance impressed me so profoundly that I feel that I owe it to the medical as well as the legal profession to briefly consider it on this occasion. Without referring to names, dates or places, I shall simply state the facts in the case and then proceed to study them from a medico-legal standpoint.

A gentleman of middle age was injured in a railroad wreck which he claimed caused a floating kidney on his right side. Beyond this his personal injuries were comparatively slight. He presented his claim to the company, which did not deny its liability as to the cause of the accident in which he claimed to have

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[illegible]

[illegible] that [illegible] intelligence. It [illegible] and a [illegible] being respon- [illegible] abnormal condition: [illegible] to show from [illegible] probable for a [illegible] after having [illegible] whether he [illegible] of the float- [illegible] study

of this case it becomes necessary to briefly consider the clinical features of a floating or movable kidney.

1. Its frequency. 2. Its tendency to spontaneous repair. 3. Palliative treatment for its relief.

Its frequency.—In this connection, I have been unable to obtain any reliable statistics except that a floating kidney occurs much more frequently in the female than in the male, and that in a large majority of cases, the right kidney is the one effected. For years I have been particularly interested in this subject and during that time have made hundreds of examinations for various diseases common to the abdominal cavity, and with few exceptions have I failed to examine the patient, carefully, for a displaced movable or floating kidney. I have rarely found the left kidney floating, but I have found the right kidney floating or movable in female patients very frequently, so much so that I am inclined to believe that it is much more common than it is generally supposed to be. In all the examinations I have made, I can only recall some two or three cases in which I have found a floating or movable kidney in the male. It seems to be an exceedingly rare occurrence in this sex, so much so that I feel that we are justified in saying that it is only in exceptional cases that we find it existing in the male at all.

Its tendency to spontaneous repair.—There is not a case of movable or floating kidney that has come under my observation in the male or female that has made a spontaneous recovery. In conversation with medical friends who have had experience in this class of disorders, I have thus far failed to find a single case in which there was reason to believe spontaneous

recovery had taken place. In fact, if we study the pathology of floating kidney, we can not reasonably expect spontaneons recovery, for the reason that in the true floating kidney, the organ is surrounded with a meso-nephron, and hangs by a pedicle, free to move within the abdominal cavity in any direction. The anatomic relations of the kidney with the peritoneum are such that when it has a meso-nephron, the peritoneum has been displaced to such an extent as to form a capsule, which even the most expert operator is unable to replace. This, being the fact, it is unreasonable and impractical to expect spontaneous recovery.

A movable kidney is distinguished from a floating kidney from the fact that it does not have a meso-nephron, but is free to move underneath the peritoneum, which it dissects from the lumbar muscles, and when once loosened, permits the kidney to move to and fro underneath it like a shuttle.

A displaced kidney may be congenital or post-natal. I recall a case of displaced kidney which I observed a few days ago in an abdominal operation. In this case the kidney was very much distorted and located just over the promontory of the sacrum. The patient had never complained of any pain or trouble with the kidney and had it not been for an operation for the removal of the ovaries and uterus it is quite probable that no one would have been the wiser. In considering a displaced kidney, we shall not include those of a congenital origin, but simply, where it has by some external force been displaced and lodged in another part of the abdominal cavity and anchored there by inflammatory adhesions. The tendency to sponstan-

eous recovery in cases of this kind is not very flattering, and I am frank to say that in my experience I have never had the pleasure of seeing a case in which such displacement existed and spontaneous recovery took plaee. From these few observations I am led to believe that any one of these conditions may be tolerated by the patient,and the kidney and the surrounding structures may so accommodate themselves to their new environments as to relieve the patient from pain to such an extent that he may apparently recover his normal health; as a rule I do not believe that this is true but, on the contrary, I have found in these cases a general tendency on the part of the majority of patients, at least, to get worse. If not troubled with actual pain, they become nervous; their digestive system is disturbed as well as the functions of the kidney itself, which, of necessity, sooner or later lead to grave systemic complications.

Palliative treatment for its relief.—The palliative treatment which has been recommended for years in our text-books for the relief of floating or movable kidney is in my judgmeut worse than useless. I am not insensible to the fact that our best writers recommend the use of bandages and compresses for the treatment of this disorder, but why they should recommend such treatment is beyond my comprehension, except that somebody who wrote a book sometime before had recommended such a thing and like the traditions of old, it has been handed down from one generation to the next. Certainly there is no logical reason for the use of bandages and compresses in the treatment of floating kidney. If you stop a minute and study the anatomy of the human body you will

readily see that no bandange can be placed over the abdomen with safety to the adjacent structures that will have the slightest influence in holding the kidney in its place. It is only necessary for you to cut a cadaver in two, crosswise on a line with the kidney, and you will see at once that the kidney is not *only* protected by the ribs posteriorly, laterally and even anteriorly, but it is also guarded by the vertebræ, which in the majority of cases project beyond the level of the kidney so that if it were practical to bandage a patient so tight that the bandage would rest on the anterior portion of the spinal vertebræ it would not be sufficiently tight to hold the kidney in its normal position. It is only necessary to examine an articulated skeleton to demonstrate this for yourself, when it will be evident how utterly absurd it is to expect beneficial results from this method of treatment. But I amagine I hear some one say that this can be overcome by compresses. Admitting that you can make a compress that will fit down between the ribs and spinal vertebræ so as to make pressure on the kidney, I defy you to hold the kidney in place with any such compress, without injury to the adjacent structures as well as the kidney itself. Worthy Fellows of the Academy, in summing up these observations, I want to call your attention to the fact that a movable or floating kidney in the male is quite an unusual occurrence; that the tendency to spontaneous repair is exceedingly rare; that the palliative methods heretofore advised and used for the treatment of this condition are anatomically and physiologically impractical.

Legal aspects.—To properly consider the legal aspects of a movable or floating kidney it is necessary

for us to consider, as we have already done, the clinical conditions which exist in these cases. The legal responsibility depends largely on circumstances, and circumstances are usually the offspring of facts. In studying this part of the subject we shall divide it into three divisions. 1. In acute diseases. 2. In chronic cases. 3. In alleged spontaneous recoveries.

The legal aspects in acute cases.—The legal aspects in acute cases of movable or floating kidney depend entirely upon the legal responsibility of the company. If a claiment has, without any fault of his own, been the victim of an accident, which accident had been entirely the fault of the company and as such has resulted in an acute case of movable or floating kidney it would only be necessary to show that these were the facts in order to establish a claim against the company. The defense would not be justified in setting up the claim that the party may have had a predisposition by reason of general disability, to a displacement of the kidney, because it is presumed it will use every reasonable precaution against injuring any of its patrons whether they be in enfeebled or of robust health.

The legal aspects in chronic cases of floating or movable kidney.—While the company may be responsible to a claimant for injury by reason of an accident, such responsibility is not lessened so far as the company is liable for negligence, but it is lessened by reason of the fact that a diseased condition existed prior to the accident and may have been exaggerated by the accident; but not in fact a primary result of said accident, hence the company should not be held

responsible in a case of this kind to the same extent it would be held responsible in a case where no such chronic condition existed.

Allow me to illustrate. A few months ago I was called as an expert witness in a case that was being tried before the United States court, in which it was shown beyond dispute that the claimant had suffered from tuberculosis of the hip joint in childhood and had been treated for the same for years, finally recovering sufficiently from the disease to do a certain class of manual labor but leaving him a confirmed cripple. Outside of this crippled condition his general health appeared to be normal. He was riding in a sleeping car on one of the trunk lines of Ohio when a very trivial accident occurred causing a sudden stoppage of the train, but being in the sleeping car riding with his head toward the engine, he suffered no visible injury whatever, did not know what happened until he got out of the train and made inquiry, after which he went back into the car, went home, and some days afterward complained of his old trouble; was taken down a few weeks later with suppurative morbus coxarius in which there was multiple infection. The abscess was opened by a competent surgeon but the patient died of pyemia and the company was sued for $10,000 damages. In the trial it was shown that there was a head-end collision, which, of itself, held the company without any further evidence of negligence. It also developed that the claimant had suffered from hip-joint disease long before the injury, and although he had for the time being apparently recovered, yet he was predisposed to its return. The expert witnesses for both the prosecution and the defense con-

fined themselves to scientific and clinical facts rather than taking sides in the case. The attorneys for both plaintiff and defendent, who were among the most able counsel in the State of Ohio, showed a remarkable disposition to get at the real facts and place them fairly and squarely before the jury, which was one of more than ordinary intelligence.

In summing up the evidence brought out in the trial, it showed that a party who had suffered from hip-joint disease prior to any aceident had a predisposition to the return of the disease, and hence, a very slight injury that would not affect a healthy person in the least, might result in the return of the tubercular trouble and to that extent the defendant was not liable for damages.

As a legitimate result the jury rendered a verdict accordingly, giving the administrator a few hundred dollars instead of several thousand.

From this I observe that it is only fair and reasonable to assume that where a floating kidney existed prior to an accident, that the defendant in an action for damages is not responsible for its existence, although it may have exaggerated its condition, and hence should only be held liable for such injury as is clearly shown to be the direct result of the accident.

Legal aspects in alleged spontaneous recovery.—If a claimant has suffered from a floating or movable kidney and alleged to have recovered from such abnormal condition, received an injury in which he assumes to have had a return of his former trouble, and on account of return of said condition claims damages, it becomes necessary for him to show, beyond a question, that he had fully recovered from his former diseased

condition and to show that his present abnormal condition was wholly due to negligence on the part of the defendant and in no wise the result of the former diseased condition before he is entitled to damages for the same.

In conclusion, it has been my experience that the disposition to spontaneous recovery with or without palliative treatment, in cases of floating or movable kidney, is not warranted by clinical observations. This being the fact a jury is not warranted in awarding the same damages to a claimant as if the whole injury had been caused by the accident, although he may allege to have recovered from his former adnormal condition prior to the accident, but they may award such damages as the evidence shows was the direct result of the accident.

68 Buttles Avenue.

DISCUSSION.

Dr. GALBRAITH—Mr. President and Gentlemen of the Academy: I desire to compliment the Doctor upon his courage in selecting so unique and unsatisfactory a subject for a paper. In the first place the difficulty in making a diagnosis of a floating or loose kidney is readily understood by every member of this Academy. Again, the subject being so unusual that in the doctor's description he has not cited or brought to our notice a case of a loose or floating kidney either so as to speak of idiopathic or traumatic case but has confined entirely those conditions to females. We can readily and in a measure understand that the exciting cause of floating kidney in females is the result of tight lacing, and as the doctor mentioned it is invariably confined to the right side; in connection with crowded and depressed viscera you do occasionally find this condition in a female from this cause. That we should select or bring up a case for discussion of so unusual occurrence struck me as of little benefit either for ourselves or for our companies. I am afraid we are running too much into peculiarities, idiosyncrasies and unique ideas that will not only cause

comment from our superior officers but from the public at large. In nearly all the railway meetings of the last two or three years I have attended there have been something new as the result of alleged traumatism. Now as regards the medico-legal aspect and treatment of floating kidney, I doubt if we would be justified to the extent of the heroic and mutilating methods that are advised. In the first place the Doctor has not cited, as trauma or the results, a case that has been approved. I failed to note anything of that kind in his paper. Now we have the palliative treatment; our text books say we will apply a bandage and compress, and in the case of a loose kidney as the result of trauma we have a dozen or more text books stating positively that to apply a compress and bandage is the principal thing. In this the Doctor takes exception to the authorities. Now then are we justified in proceeding to perform an operation that the Doctor has very well and satisfactorily demonstrated? Is that protecting our company, or do we as individuals assume the responsibility of so heroic surgical interference?

Dr. E. Wyllys Andrews—I would like to ask Dr. Reed whether it is not true that perhaps the majority of our cases of floating kidney are accompanied by disease of the organ, of course producing an enlargement, hypertrophied condition or dilatation; that the bandage with an exceedingly large kidney is of use? While it is anatomically true that no force can be exerted on a normal sized kidney, may it not be true that a movable large kidney can be restored and the pain somewhat diminished by a soft compress?

Dr. Lemen—I would state that my experience with the bandage has certainly given more or less relief in floating kidney, as Dr. Andrews says allowing for an enlarged kidney but especially in a relaxed abdomen; anything that will give support to the abdomen will more or less support the contents therein, and I have had several cases that had a great deal of relief by simple abdominal support. It did not cure the trouble, but acted as a simple palliative measure to relieve the distress as a truss.

Dr. Owens—I beg to differ with my friend (Dr. Galbraith) in reference to the importance of the subject. The gist of the paper is this: That given a case of floating kidney, or a kid-

ney that is capable of being displaced, and a railroad accident where it could be afterward shown that a displaced kidney existed, and then the evidence comes in that displacement of the kidney once existed and offered in evidence—may be shown from professional standpoint that such displacement did exist but that it had been cured by a bandage and that the jar or shock had displaced it—the question comes, is it possible to cure a floating kidney or displaced kidney by a bandage? I must say I am in full accord with the paper. The kidney may have general support by means of the bandage and it will be helpful and comfortable more or less, but in no sense is it cured. And we ought to be able to show sooner or later that it is not possible to cure a floating kidney and hold it there till it remains fixed in a healthy state by means of the bandage. I did not see anything in the paper that urged an operation, but the plain question is whether we can cure a displaced or floating kidney by means of the bandage, and if we can not we ought to be able to show that such is the fact. I have one case in mind on the Northwestern in which a girl was injured and she had complained of various ill-defined symptoms; she passed through the hands of one or two and finally an expert diagnosed a floating kidney and operated, and it was claimed she was entitled to damages. I think from a medico-legal standpoint the position taken by the writer of the paper is very correct and will be sooner or later recognized.

Dr. Rankin—It seems to me the most important question is, are we forced to admit that trauma can produce floating kidney? There is such close sympathy between all these organs —they have a common peritoneal covering with the entire viscera—and these organs, with the kidneys, vary so much that it seems to me that we have not sufficient proof that trauma is the cause of floating kidney at all. It is certainly very difficult for me to understand how it could; anything that would displace the kidney would bring on inflammatory reaction around the kidney, which would have the reverse action—make it stick instead of float. Can we under our present state of knowledge admit that trauma can produce floating kidney at all? I doubt it very much.

Dr. Harnden—One well authenticated case came under my notice. A woman had been treated for some years for floating

kidney by compresses; she was better in health and it was claimed she had been cured. She was taken sick something like a year after the supposed cure had taken place and her case was diagnosed then as an aneurysm, and she went from bad to worse till she was in a hopeless condition. I was called in consultation to see her and I pronounced it floating kidney. She died something like two weeks after that time; an autopsy was made and it was found it was floating kidney and there was no indication of cure in the case; the kidney, like a shuttle, passed about in every direction, and it seems to me the limited description of the kidney and its attachments would bear out the idea that it could not be cured by any such means. It seems to me, an application made through the abdominal tissues and surrounding tissues would be utterly futile in holding in position the kidney. And furthermore I think it is about on a par with the treatment of hernia; when the kidney has lost its attachment, the pedicle has become elongated. I do not believe there is anything that will cure it but shortening the pedicle and tying it up.

Dr. Hawes—I have known a great many cases of floating kidney that were alleged to be very much improved by bandages and trusses and quacks, and for all that, notwithstanding the testimony that has been adduced in their favor I am strongly inclined to the opinion it was not in a majority of the cases a disease of the kidneys so much as a disease of the imagination. There is a large per cent. of the cases where floating kidney is alleged to be found, as we know, in hysteric women, and if we were able to make an exact diagnosis and able to see the exact results of our treatment without being able to give any reasons except such as had been satisfactory to me and the result of observation in the past, I should feel strongly inclined to believe the very respectable per cent. of such cases was discomfort arising from the imagination rather than from the kidney.

Dr. Galbraith—Before closing, permit me to say, if memory serves me right upon the literature of this subject, it fully concurs with the evidence we have had here as regards it being almost invariably found in women. I further doubt, as already stated, that there is in this Academy or in this city a case of floating kidney which can be postively proved beyond doubt

due to trauma. If that were the case—that such conditions could result from trauma—stop and think, nearly 200 men are injured on the railroad to one woman, and I fail to discover, either from the evidence here or from the text books I can think of, a case where this condition has been alleged and damage proceedings brought against the railroad for this condition in men. Now then we do perform operations successfully for the anchoring of the kidney, but in alleged floating kidney the results of an injury to an employe or a passenger upon a railroad, are we justified in resorting to those methods which the Doctor has described and the text books describe, to cure the condition? I doubt it. I doubt if we would be using proper judgment in resorting to anything of an operative character. As to the medico-legal aspect of assuming responsibility of these cases I am not prepared to remark, but in my judgment we would be to a greater or less extent responsible for the direct result of this operation. In reviewing this subject I find that the text books merely mention the fact that it may be the result of trauma—that is very unsatisfactory (laughter), it is like a great many other subjects in our text books, very unsatisfactory indeed.

Dr. LEMEN — Why would you [Dr. Galbraith] hesitate to operate on a floating kidney that was the result of trauma, any more than on hernia that was the result of trauma?

Dr. GALBRAITH—I think I have made that very plain, that the moment we perform the operation for traumatic floating kidney we are confronted, as the author of the paper says, by a dozen or more text-books stating that the bandage, compress and various appliances are recommended.

Dr. REED—I am very sorry our distinguished friend, Dr. Galbraith, "got off the eggs on to the straw." My paper did not consider the question of anchoring the kidney, did not consider it as coming in this discussion at all; and furthermore, I did not say in the paper that there was such a thing as traumatic displacement of the kidneys; the question is asked whether I ever knew of one—I think I can cite several cases which I have every reason to believe were traumatic. One case of a young girl in this city, lifting a bucket of coal, and as she said, something gave away in her right side, she felt sick and faint, was placed in bed and was an invalid—that was not imagination.

Having been a citizen of Columbus she came home, and was brought to me by her family physician; an examination was made and I could very easily, as she was a thin, spare girl, move that kidney from the bottom of the pelvis under the edge of the ribs, a distance of three or four inches, as plain as anything. I made an operation for anchoring the kidney. Two years ago the lady was brought to me with an ovarian tumor and I made another operation—thought I, this is my time to examine the kidney and see whether it is fast or not; because we had a distinguished member of the profession who said the kidney was loose again, and I was more than interested because my operation was challenged. I made that examination, and the kidney was fixed in its normal place. That was a case where lifting occasioned the injury, a floating kidney was found, it was operated on, it got well, and it seems to me that is conclusive that we have such a thing as traumatic floating kidney. In another case a young man playing ball was struck in the abdomen, was taken with severe pain immediately afterward, and from that day to this has never been well, though he was the strongest young man in that section of the country. But on examination you can find the lump in the right side, that can be slipped up and down a distance of two or three inches, and I believe is a floating kidney, the result of traumatism. I can not prove this matter any clearer, but however, let that be as it will, it does not enter into this discussion of the medico-legal aspect of the paper, because here comes a man who was injured on the railway; he admits having a floating kidney, but claims to have been cured of this and now comes up to the company and gets $12,000 damages, and gentlemen, dare we stand and ignore these facts, if they are facts? Twelve thousand dollars is pretty rare; I would not want to pay it, nor have my company pay it unjustly. The fact is that these cases come to us, we must study them and, as I said in the beginning of the paper, because they are rare, it catches us unprepared, and when this case was tried there was very little testimony that could be gotten at. Further than that, we find the text-book, as I have already said, is absolutely useless because it is false —I do not believe he ever was cured and I do not believe he was entitled to damages. That is the reason I bring this out, and it seems to me it is fair and just and reason-

what seemed to be or at least simulated closely the delirium of shock.

I will cite one case, an engineer, whose engine came into collision, knocking the cab into kindling wood. He jumped off and fell upon one knee in the gravel, slightly bruising the skin over the knee-pan. He stoutly asserted that his limb was crushed, and while they were conveying him home upon a stretcher, continually cried out, "Oh! go and get my leg," screaming at the top of his voice the same song without change of tune or tone, and the sight of his leg or my argument and most emphatic assurances made no impression upon him. He appeared to be in terrible agony, his anguish so pitiful as to excite the crowds of sympathizing friends almost to frenzy. When I had satisfied his friends that he was not injured at all, and they began laughing at him, he sat up, took a careful survey of his limb and emerged from his delirium.

I do not deem it necessary for me to give a recital of numerous cases of this peculiar inversion or perversion of mentality. I wish, however, to cite a case of pure delirium of shock accompanying a severe and fatal traumatism. A man and his mistress were run over by an engine, picked up and carried into our elegant temporary hospital, the baggage room. The man died in a few moments, and the woman lying by his side with a severely crushed leg, seemed utterly oblivious of her condition or his presence; answered questions promptly and correctly, giving me her name, residence, etc., said she was "in no pain." "Oh, I am all right, doctor," sang merrily and chatted lovingly, as she seemed to think, with the husband she had

dishonored and left, and seemed to be going rapidly over her happy married life, but with no allusion whatever to her paramour or her injuries, ignoring anything said to her upon either subject, and yet seemingly perfectly rational when asked her name, residence, etc. When asked if her limb hurt her, lifting and examining it at the same time, she answered very promptly and frankly, "No," and at once resumed her happy songs and loving chat. At that time she had no perceptible pulse and, in fact, died in a short time. This case is perhaps a fair illustration of the delirium of shock.

I will only impose upon your patience and credulity by quoting one more case, similar to the above, but with different result. In this case the man, age 22, was run over by a loaded box car, the flesh crushed and entirely torn from the bones of the leg and thigh up to mid third, requiring amputation in upper third. There was slight manifestation of delirium and utter oblivion, as in the case just mentioned, of his injury. He would look at the mangled flesh and denuded bone, and then without seeming to realize that he was seriously hurt, would ask me if I would have him fixed up in a few moments, so he could go home. There was no mental excitation in this case. The loss of blood was considerable, pallor, lowered temperature, pulse, etc., indicated a grave degree of shock, and in fact, this case was typical of many I have seen which have proved fatal, and I fully believe this one would have proved so, but for the modern heroic measures for the restoration of vitality. The intravenous saline injection, hypodermic injections of nit. strych., nitro-glycerin, etc., and external heat were

used, and this case, which I had pronounced fatal made a nice recovery.

Now, gentlemen, I believe the other case—occurring some years prior—might have been saved in spite of the fact that she exhibited in more marked degree the delirium of shock, as her injuries were not apparently as severe as in the latter case. I have an idea that the modern treatment of shock may perhaps change materially the experience of surgeons as to the fatal indication of this form of delirium.

The delirium of shock met with upon the battlefield, with its attendant exciting environment, is in many respects similar to that observed in railway accidents. I have passed among the wounded after some of the great battles in our late war, and noted numerous instances of this peculiar delirium. The "shock of battle" in itself produces delirium, as I well know. I was not conscious of a severe wound until my attention was called to it by others. The awful groans of the wounded and dying, of which the historian and poet tell us, were often mingled with the chattering and happy songs of the mangled and expiring soldier, and in both instances, as a rule, the victims were unconscious of any actual mental or physical suffering.

Intense and unquenchable thirst is usually, and invariably I might add, the greatest suffering experienced by the wounded. Who has ever yet satisfactorily defined or explained this awful thirst for water? What is the condition which checks the sufferer in his muttering or delirium, and prompts him to ask coherently, often imperatively, for water, thank the giver, and relapse into a condition of unconscious

anguish? Is it dissolution, molecular disintegration of vital nerve centers, or a peculiarly disturbed and exalted mentality, akin to catalepsy or hypnotic suggestion? The functions of the brain seem sensible and exalted, often keen and brilliant. These cases certainly exemplify the fact, that severe traumatic conditions are not usually attended with much pain during the manifestation of shock; are they hypnotized by their terrible environment into a condition of anesthesia?

A very plausible explanation of the cause of serious and fatal shock, with its attendant symptoms of delirium, etc., seems to be the molecular disintegration of the nerve centers, or nerve fibrilla. The impaired respiration, diminished arterial tension, cardiac depression, musculo-cutaneous anesthesia, sub-normal temperature, etc., would certainly indicate this. Certain it is, the brain often retains its functions to the last, exalted and bewildered, it is true, but still the citadel of the mind, obeying its demands, even when the bodily functions are paralyzed and undergoing rapid dissolution, and acting with unusual rapidity.

I have often heard dying men give instruction as to the disposal of their effects, describing accurately where they could be found, and going into details that a lawyer would not think of, as though conscious that dissolution was rapidly approaching and yet apparently unconscious of their physical condition, or the nature of their wounds. It is a pitiful and strange scene to witness the dying look, keen and yet vague, brilliantly pale, almost phosphorescent; the bright, keen and shimmering eye; the hoarse and gradually fading voice; the imperative, pleading, pathetic

demand for water! more water! as if its cooling influence might assuage the awful anguish. The poet exclaims:

"Death having preyed upon the outward parts,
Leaves them insensible; and his siege is now
Against the mind, the which he pricks and wounds
With many legions of strange phantasies;
Which in their throng and power to that last hold,
Confound themselves; 'tis strange that death should sing."

Charcot, Oppenheim, Strümpell, Guion, Thorburn, Dreschfield, Weir Mitchell and others seem to be exponents of the theory that hysteria enters largely into the element following traumatism in many cases, but others dissent from this view, and it seems to me wisely. I do not myself like the term "hysteria," especially when applied to such conditions.

In Georges Guion's work we learn that "many of these disorders arise, not so much as the result of an immediate cause, but from the state of the nervous system being such that an exciting cause is able to provoke it to the manifestation of functional disorder."

Page, in his admirable work on railway injuries, claims that "these nervous disorders have their beginning in profound mental shock, and the cause will be found in the cerebral cortex, and that the mandate of the brain through the spinal cord is checked, as indicated by inability to protrude the tongue or move the limbs."

There is no doubt in my mind that the suggestion, or autosuggestion element, enters largely into these cases, and might properly be termed "traumatic suggestion," but for the fact that they are observed in cases of psychic shock unaccompanied with traumatism.

Railway accidents are usually attended with an element of severe nervous shock, not only to the injured, but to every one present. My experience has demonstrated, to me at least, that there are distinctive features in railway shock, and I believe the element of psychic shock is far more common in such accidents than in those met with elsewhere.

It was not my intention to go extensively into the discussion of shock, or to quote at any length the views of authorities upon the subject of the delirium of shock, but simply to call attention, briefly, to some points relative to the importance of this peculiar and usually fatal indication, believing that a more thorough examination and discussion of the subject at the hands of the learned gentlemen of this Academy might result in a better understanding and improved methods of treatment of the more severe forms of shock. The practical application seems to be that we should bend all our energies and efforts to overcome this element called traumatic shock, especially those cases attended with delirium, unless, indeed, the poet be right in assuming it to be dissolution or death.

I am frank to say that up to a recent period I have invariably given an unfavorable prognosis when this *well-defined* indication of grave element of shock manifested itself and did not feel warranted in resorting to measures for its relief when accompanying severe traumatisms.

DISCUSSION.

Dr. JAY—Delirium is a disturbance of the cerebral functions manifested by impaired action of the nerve centers, characterized by hallucinations.

Shock is the depression or grave effect produced by severe injuries, operations or strong emotions; a relaxation or sus-

pension of the sustaining and controlling influence which the nervous system exercises over the vital organic functions of the body. It is the result of a profound impression made on the cerebro-spinal axis, either directly through the agency of an afferent nerve or through the circulating medium. There is a peculiar condition in which the manifestations of shock are due not to severe bodily injury but to purely mental causes. This variety of shock may be even more profound than that produced by bodily injury. The mental impressions produced by railway accidents come under this head; while the precise change which takes place in the cell structure of the ganglia of the cerebro-spinal system, to produce the delirium is caused by a change in cell relations produced by the shock, either bodily or mental, certainly seems plausible. It may be that the cell structures of the brain are unduly stimulated as in the delirium of intoxication, or from an anemic condition as in low grades of fever accompanied by delirium. A child will become delirious from mechanical irritation of the digestive tract reflected through the spinal cord to the brain. In any and all forms of delirium there must be a change in the physiologic condition or the anatomic relation of the cerebral cell structures, and does it not seem probable that the anatomic relations of the cells have been temporarily changed; that the shock has disturbed the natural relations existing between the minute cells; any such disturbance of the cerebral cell structures must disturb or derange the mental processes, and the disturbance of the mental processes is the delirium? This disturbance of cell arrangement may be that the location or position or peculiar grouping together of the cell structure have been temporarily changed and the delirium will continue until the physiologic relations have been restored. Mental processes may produce this change in cell arrangement, and delirium follows. The part or organic structure involved must be the same, and similarly affected in all causes of delirium or else the mental processes do not have a fixed and definite location through which to make manifest their marvelous doings, or in which to record their wonderous achievements. In delirium the intellect or mind is not impaired, but the organic structure, through which the researches and investigations of the intellect are made known and in which they are recorded,

are not in perfect condition to receive them, hence the wandering. Often this cell derangement is soon restored by rest and quiet alone. At other times help is furnished by medical aid or surgical assistance. Whenever or by whatever means this is accomplished the delirium has ended, the intellect commences where it left off, at the beginning of the delirium, and the individual is himself again.

Dr. Cole—Dr. Jay, who opens the discussion, has talked about everything but delirium of shock.

Dr. Jay—That shows how little you know about it.

Dr. Cole—That shows, Mr. President, how little any of us know about this subject. We know no more today than our forefathers did a hundred years ago about shock, and until some one gets ready to make an exhaustive and systematic explanation upon the different orders of animal kind we are not likely to. The French school, strange as it may seem, disclaims any such condition as shock and traumatic shock. I say strange as it may seem, because the French are of a neurotic temperament, and it is generally agreed that shock has to do primarily with the nervous system. We know that a snake's head may be cut off and they will live not only till sundown but perhaps several days; we know the same thing is true of other animals in the lower orders. Those of us in active practice know that the cases where we get what is called shock most pronounced are, as a rule, among patients of a nervous temperament, whether it is molecular changes, or whether it is as the French claim entirely due to the loss of blood—which claim to my mind is ridiculous because we have all seen shock where there was no excessive hemorrhage; whatever it may be, no one has as yet been able to determine, or give a satisfactory definition of shock. We see it in so many forms, including the delirium of shock which the author has so beautifully written about. It would be desirable if this Academy, representing an important branch of surgical practice, a class of surgical work where this element so largely predominates, could in some systematic way elucidate this subject.

Dr. Reed—Just one point I wish to call attention to in this discussion. I do not propose to try to throw any more light on the question, but I do not think it is quite the right thing to allow the remark which our distinguished Fellow made, to go

without a little check on it. I think the Doctor did not intend the meaning to be conveyed which seemed to be conveyed in that respect, and that is that shock was the result or might be the result of the shaking apart of the cells of the brain or the spinal cord. The point I wish to make is this, that while that has been advocated I do not think there is good reasonable ground on which to establish a theory that would carry it out. For instance, a man is shot through the head—and I have seen more than one person shot through the head fall down and get up and walk off—and there is some shock, and the man gets well after all this. I saw a man in whom I am sure the cells were very much torn; he had a buzz saw cut his skull open from the occiput to a point between the eyes tearing out the sinus—and not a small buzz saw but a large saw—and that man got well to my positive knowledge and lived ten or twelve years afterward; and I made a postmortem—after his death, of course (laughter). The point I want to get at is this: There was a very marked disturbance of the cells of the brain, and yet that man did not have any marked shock, he did not have any delirium. I know another case that was hurt on a railroad in an accident near Loudenville, O., the whole side of the head was crushed in; that boy got up and in less than two minutes he walked two blocks from the engine leaving a part of his brain lying on the platform, and dripping over him, and he did not become delirious. I begin to think that the theory which the doctor did not qualify, is untenable ground, and we should be careful in taking such a position, first, because it is not tenable, and second, because we have "our friends, the enemies," ready to say that is the cause of all the spinal calamities we go into court with. I do not think it is right to take that ground which is dangerous and which has a foundation not absolutely tenable. I simply bring these cases up as evidence that it is not always, at least, shaking up the nervous system that produces delirium.

Dr. Bryant—I am not a pathologist, but I have a friend who is a histologist and pathologist, and he tells me that all cells, nerve cells as well as others, eat, grow, reproduce and have motion; and as a pathologist he says shock is due first to lack of eating—nutrition; he tells me the loss of blood will cause shock, interfering with nutrition; anything, like joy, grief or fright, which will interfere with digestion will also

cause shock—it interferes with the nutrition of the nerve cells —and that is as far as I can go in this matter; but I think that is correct, and perhaps time will prove it.

Dr. HARNDEN—I had thought perhaps I would elicit some information on the cause of the peculiar condition. I find I have failed in my object. I am satisfied we will not be able to find the cause, the peculiar condition. I do not think I have expressly stated in any part of my brief paper anything which explains the condition to my mind or to yours; I thought Dr. Reed was going to give an explanation, and he got the buzz saw started half way through the man's head, but I found he stopped the demonstration, and I stop too.

DISEASES OF RAILWAY MEN CAUSED BY THEIR OCCUPATION.

BY J. F. PRITCHARD, M.D.
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All occupations nearly, affect the human economy in some peculiar manner. Where there arises a strain of the physical system we find diseases affecting the muscles, joints, bones, etc., and when the strain is mental the nervous system is found involved. These facts are so common that they are truisms and need no demonstration.

We would expect to find among railroad men a complication of diseases from the very nature of the occupation. There is no doubt of intense mental strain at times, and the general muscular system is subject to a degree of fatigue almost past endurance, which must produce its effect; but I find upon investigation that but little attention has been paid to the subject, and my only hope now is to direct your attention in this direction in order, if possible, to reach some clear conclusion regarding the effect of occupation on railway men, and its ultimate effect in case of injury.

The following, quoted from a stray medical publication, shows evidently that others have been giving this subject attention.

"Neurologists are watching with great interest a

new expression of nervous malady which has appeared since the introduction of the Broadway Cable cars and the Brooklyn trolly system. With the exception of Chicago there are no cities having so much street traffic as New York and where these methods of transportation are in operation. A nervous state unlike that which is excited by great noise or sudden danger has developed in several gripmen employed on the Broadway road and among the motormen of the Brooklyn trolly lines.

The constant lookout for collisions in the overcrowded district below Canal Street in Broadway keeps the gripman in a state of extreme nervous tension from the hour he goes on his car until he goes off duty. Besides keeping an eye open for visible trouble his mind dwells on possibilities that are under his feet. He does not know when there is to be a pooling of interests between the grip and a broken strand in the cable which will whisk him along the street into trucks, smashing wagons, frightening people, and exasperating the city fathers. This nervous strain results first in wakefulness, then in loss of appetite and extreme irritability; after this a tremor in the facial muscles. At the end of a week, says the medical examiner, all of these symptoms disappear and do not come back for ten days, but afterward the intervals are regular, about a week apart. Seven days in a state of nervous terror and seven days in a healthy state apparently. These symptoms apply only to men of nervous, nervo-sanguine or bilious temperaments. While present in other temperaments they are not pronounced."

I am informed that on some English railways where

very fast trains are being run. only young men as engineers are employed. After running for a length of time they can not make the schedule, and as there is a fine for delay of mail at the rate of one pound ($5) per minute it seems to be important that the train reach its terminus on time. Why are experienced men unable to do this? Is it not from some depressing effect on their nervous system?

I have three notable examples of the influence of their occupation as engineers.

The first was an engineer on passenger trains. He never had an accident but developed severe neuralgic pains in various parts of his body, notably his head and back; was troubled with chronic cough also, and finally was pensioned on light duty on account of his disability until the road was sold, when he returned to duty on a branch line, but suffered at once from severe girdle pain and great lassitude, which finally developed into an epilepsy with gradual softening of the brain. He is now at times unable to walk, has regional paralysis, is unable to talk at all, and can live but a short time. This man is a pensioner, was discharged from the army for disability affecting the lungs, but recovered and to my personal knowledge had charge of an engine for nearly twenty years. I am satisfied that his present condition is largely due to his occupation and the nervous strain attending it.

In the second, also a passenger engineer, and one of the best, he had the misfortune to run into a washout without injuring any one except some few slight scratches, although the train was very badly wrecked. After a month or more he was set to work as a conductor. but made a failure of that as he seemed to be unable

to comprehend the time-card. He could not stay on an engine when running as he seemed to become paralyzed with fear. He was given a position in a roundhouse and shop, which position he now fills, but he can not run an engine because of a return of his nervous symptoms, although fifteen years have passed since the accident referred to. In every other respect he is in perfect health.

In case third, also an engineer of the first-class, while running a passenger train on a branch line collided with some cattle and his engine was thrown off the rails, but no damage done. He has never since been able to run on any fast train, and is now pensioned on a short branch line where he does effective work. He informs me that he becomes nervous and unstrung when running fast or on the main line, and in deference to his wishes he has been kept on easy work since his accident, now nearly sixteen years.

I will refer to but one or two more of this class as showing in my opinion the effect of mental strain due to occupation. A case reported by Charles S. Potts, M.D. Mr. A. R., age 28 years, a railroad engineer, was perfectly well until three weeks previous to coming to the hospital. At that time while attempting to save a man from being run over he had a narrow escape himself. Since this he has been very nervous and excitable. He complains of restlessness at night, frequently walking in his sleep, palpitation of the heart, headache, and of being confused mentally. There were also dyspeptic symptoms which he says did not exist before.

The *Brit. Med. Jour.*, says that there is reason to believe that at all times there are men on the line who

are working very near the breaking strain. We may in regard to this mention three well-known instances which at the least show the tension under which work is carried on. A station master seeing a man run over on the line, himself fell down dead upon the platform. Here was a shock which permanently made his heart stand still; and how many times had not that man's heart stood still before? We may feel perfectly certain that if the major shock could kill, the minor daily shocks of a railway life must have greatly damaged a heart under the influence of the nervous system.

Two trains collided at a junction. It was either the fault of the drivers or the rails, certainly not the signalman. The signals were right; yet when the box was entered the signal-man was found to have gone mad and had to be taken to an asylum, where he remained for long. He was broken utterly by the horror of the dilemma. But what shall we say about the smaller dilemmas which every hour of his working life he had to solve? Did they not also have an effect, although a lesser one, on the brain?

A few years ago it was found that the sickness rate among signal-men of certain lines was becoming excessive, and it was determined to do away with the system of leaving to one man the whole responsibility of taking charge of a signal-box. At great expense every box along the line was supplied with two men. Great evils were prophesied. It was thought the men would talk and lark and neglect their duties. This did not happen but the sickness stopped. Under the shared responsibility they no longer broke down. If then, as seems to be indubitable, railway strain can have definitely injurious effects upon the nervous sys-

tem it becomes an important question for inquiry whether this nervous derangement at all frequently has the effect of impairing the nutrition of the heart. Upon this special point we do not at present possess sufficient information to warrant the expression of a definite opinion.

Now, while these cases are extreme and well marked, as a matter of convenience and for a basis from which to make deductions, I think we can fairly say that they are all due to occupation. And while all railway men of this class may not have similar experiences yet they all have similar mental strain from constant watching to avoid teams on grade crossings in country and town, more particularly with fast trains where time must be made regardless of every other consideration, and also to avoid crushing track-walkers. By these I mean tresspassers on the track. Have you ever ridden on an engine when ahead you see a man walking in the middle of the track as unconcernedly as though on a promenade in the park? He is going your way. The engineer puts his hand on the air valve, watching the man intently, but not slacking speed, waiting to see him leave the track. He next blows an alarm with the whistle but does not apparently attract attention. He is now so close that he can not stop, but he makes the effort, reverses his engine, puts on the emergency brake and, when he is just on the man, turns his head away to avoid the sight, but the man steps off. Yet the mental and nervous strain is just as great as though he had killed this individual. If the trespasser happens to be a child or an intoxicated man, usually he is a subject for an inquest with all of the usual senseless blame

called the attention of his physician to it? I am strongly of the opinion that if we can carefully investigate individual cases, eliminating all pseudo cases, we will find this to be the case.

One writer in summing up a paper on traumattic neurosis says, "It can not be denied that neurasthenia when produced by overwork, exhausting disease, or any of the many recognized causes for such a condition, may cause great suffering and disability when only subjective symptoms are present, and these cases would seem to prove that traumatisms should be placed among the causes." I would reverse this method and say, that the disease was existent previous to the traumatism and that the injury merely called attention to it. The symptoms of this neurosis are merely accentuated by the traumatism but not caused by it. How many cases are noted in which the symptoms are out of all proportion to the injury, and in what other manner can they be explained? Many cases of so called railway spine, and in fact all forms of neurosis, can be easily understood on this basis of reasoning.

I had only hoped in this paper to call the attention of the society to this line of study, and hope it may be a means of originating a collective investigation that may make this whole question clear. I would suggest that it be made a line of study for this learned society as I know of no better means by which to settle it.

BURNS AND SCALDS.

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In our work as railroad surgeons we are often called upon to treat burns and scalds in their various forms and degrees, and nearly as often find an unsatisfactory state of affairs regarding the condition of the patient. The severity of the burn, its first treatment by rough hands, and the time since the infliction of the injury are all important factors. These, together with some hints as to methods of treatment, will be considered.

Often we find a patient begrimed from head to foot with coal dust, oil and cinders, suffering with a severe burn, received hours before, with the injured member drenched in machine or engine oil and wrapped in dirty, oily waste, and an internal drenching of whisky or brandy. This condition must be met promptly, and here begins the tiresome task of cleansing and rendering the parts aseptic. These are the times that try our patience.

With no means at hand to dress wounds in an emergency, especially when "out on a run," our engineers and firemen can not be blamed for doing the best they can; on the other hand, it is a wonder why there are not more serious results following an improper first dressing that has remained for hours favoring, if not producing, sepsis. With modern surgery we are able to meet these emergencies successfully and bring

about satisfactory results. How best to do this will claim our attention.

As far as the conditions, treatment and results of burns and scalds are concerned, it is not deemed advisable to lay down any different line of treatment, they are in all things practically identical; therefore the term burns will include both burns and scalds.

While many of the earlier authors classify burns, according to the extent of the injury, in six degrees, the simpler classification — three degrees — is here adopted for the sake of brevity and the further reason that we believe the distinctions in the six degrees are practically unnecessary, and are in a measure confusing. The classification adopted is as follows (International Encyclopedia of Surgery, Ashhurst.):

First degree. Hyperemia, erythema; irritation or inflammation of the skin without vesicles.

Second degree. Vesication; inflammation of the skin; formation of vesicles or bullæ.

Third degree. Eschars; gangrene, superficial or deep, involving the skin or other subcutaneous tissues; carbonization of part or of entire body.

In the first degree there is rarely any constitutional disturbance (it is true that a severe case of sun burn may prove fatal), the diffused redness of the surface, some tingling or smarting pain, and occasionally some swelling are usually the only symptoms manifest; yet in rare instances the internal complications are a serious factor, depending on the patient's constitution, individual peculiarities, the impression on the internal organs being made through the media of the sympathetic and sensory cerebro-spinal nerves. Exfoliation is complete within a few days and the skin is again

normal. These symptoms are also found in burns of the second degree, but intensified because of the greater heat producing them, and in addition there is serous effusion and the formation of vesicles, following the intense hyperemia, either appearing at once or within a few hours; in some cases they continue to form for two or three days. It often happens that the vesicles burst because of the rapid effusion; when this occurs the epidermis lies in shriveled whitish folds on the super-sensitive, inflamed skin, causing pain and uneasiness, and when touched this inflamed, raw surface gives rise to intense pain. Sometimes the usually transparent serum is streaked with blood. When there is no ulceration we may find the epidermis replaced in from five to ten days.

The severity of the burn, the condition of the nervous system and susceptibility of the patient influence the constitutional disturbances. Some authors affirm that in this degree, "in severe cases shock with prostration, even immense prostration, is always present." In our experience, typical second degree cases have been treated with shock and prostration practically absent. Death may be instantaneous from collapse, or perhaps more properly neuro-paralysis, from syncope and suffocation (rarely met with in railroad injuries). If death is not sudden (in the common acceptation of the term) it may be prolonged for hours or days and result from collapse, coma, bronchitis, pneumonia, etc., thoracic lesions, lesions of the adbominal viscera, enteritis, hemorrhage, peritonitis, exhaustion, gangrene, septicemia, etc. With intestinal complications, death may result from ulceration.

The definition given of burns of the third degree

indicates plainly the prominent symptoms; the eschars vary in depth and extent; the destruction of tissue, depending on the degree of heat and duration, may be of the skin only, or all the soft and bony tissues of a part may be destroyed. This total carbonization, while not common, could easily happen to one pinioned under a wreck.

If the person survives the shock, we have a group of grave conditions to battle with; severe as are the lesions appearing in the second degree, they are not to be compared to those now under consideration. Shock is so pronounced that the question often arises, Can anything be done? I have had in my experience cases in which the burned surface was so extensive, the burns so deep, the shock so intense, that it seemed almost useless to try to do anything except relieve the suffering. Recovery did take place, convincing us that while there is life in the body, no matter how severe the injury, our efforts may be rewarded with a life saved. In this class of burns, the constitutional symptoms are usually manifested very early. We may find our patient comatose, from cerebral congestion, with a speedy death. Often there is general congestion of the internal organs, especially the lungs and kidneys. *Albuminuria is always present.* During the intense inflammation, suppuration is active, and the sloughs are rapidly cast off, leaving an exquisitely sensitive ulcerated surface rapidly covered by granulation.

During the process of suppuration, the patient is apt to suffer from exhaustion, intensified by venous or arterial hemorrhage. The nerve centers, intestinal canal and kidneys are now liable to inflammatory

changes. At this time, too, albuminuria is produced. This sympton, albuminuria, is not always noted by writers on burns. In this connection, Dr. Thomas George Morton of Philadelphia, says: "The early presence of albumin in the urine has long been recognized, but not so generally as might have been expected, for even quite recently systematic articles have appeared on the subject, supposed to cover the entire question, without a word having been said upon this important pathologic change."

Among the complication of burns, we have intestinal inflammation and ulceration, varying from simple irritation, with perhaps diarrhea, to the stage of ulceration and extensive destruction of tissue. The respiratory organs are often involved. Laryngitis following the inhalation of steam, with marked symptoms of edema of the glottis, dyspnea and intense pain. In burns of the neck and chest pneumonia and bronchitis are frequent complications. In addition to these there are the purely local complications, which include erysipelas, gangrene, deep sloughing and dangerous hemorrhage.

Among the most dangerous complications which can possibly arise, is that of a severe burn occurring at the same time that other injuries are inflicted. This is a condition of affairs which pertains almost exclusively to railway surgery. It is a subject on which the text-books generally do not even touch. No graver complications in emergency practice can confront the surgeon than that of a severe crushing or other injury such as daily occurs, complicated with an extensive burning of the surface of the body. The complication is made graver if, as not infrequently

happens, there is considerable hemorrhage. In such a case the shock impression is greatly intensified and the probabilities are that the patient will speedily succumb. In any event it is the duty of the surgeon, however hopeless the outlook may seem, to take immediate and vigorous action with a view of saving or prolonging life. The question here would inevitably arise as to which form of injury most seriously threatens and consequently requires first attention. Steps to prevent further hemorrhage, attention to the condition of the heart and nerve centers, bringing about reaction from shock and removal to a suitable place for further attention, would seem to be the chief immediate indications and perhaps in the order named. It is impossible to lay down definite rules for the guidance of the surgeon beyond these general considerations. Here, as elsewhere, his own good judgment, common sense and ability to apply quickly and correctly his knowledge must govern. The ideas advanced and rules of practice laid down in the management in this class of injuries by the older writers, are at the present day modified only to such an extent as our modern surgical practice has been changed by a better understanding of antisepsis, coupled with a better understanding of certain reflex nervous phenomena incident to traumatism of the surface of the body. As danger to life in burns of the first degree is in direct ratio to the amount of surface involved, so also are the congestions of the internal organs in large measure directly proportionate to the same cause.

This statement is not invariable or absolute, inasmuch as the danger to life due to these congestions,

which not infrequently go on to an actual inflammation, are often very materially modified by the nervous temperament of the patient. A patient of marked nervous impressionability, susceptible to the immediate effects of pain, with a surface burn amounting to little more than an erythema involving perhaps half the surface of the body, if he does not die early from shock may subsequently die of pulmonary edema, pneumonia, bronchitis or some gastro-intestinal complication, death being directly traceable to inflammation of the mucous membranes of these organs, this in turn being directly due to paresis of the vasomotor nerves.

With reference to the treatment in these cases, too much stress can not be laid upon the importance of careful antisepsis. The wounds are always of necessity, when first observed, in a septic condition, and this applies with a special force when the subjects are train men engaged in the discharge of their duties. It is not sufficient to know that chemical antiseptics and germicidal lotions should be used. We must carefully discriminate as to the class of these agents to be employed in a given case. To illustrate, in a case which recently came under my observation, in which the patient's hands were both burned over the entire dorsal and palmar surfaces, the burns on each hand being of equal severity and involving the entire thickness of the integumentary covering, I tried the experiment of treating one hand with dressings of carbolic solution and carron oil, and the other with iodoform dusted over the entire surface after a careful washing with carbolized water. The recovery of the hand thus treated with dry iodoform considerably

antedated that of the other. It would be obviously unsafe, however, to attempt this dressing in a burn involving a large portion of the surface of the body. A medical friend of mine, who is an ardent advocate of aseptic and antiseptic methods, recently killed a patient with an extensive burn involving the arms, neck and part of the trunk, by washing and afterward freely applying a bichlorid solution of the strength of 1 in 2,000.

The management of these cases involves many considerations. There is no department of practice which is more justly entitled to be denominated emergency practice than the management of the class of cases under consideration. We have to consider the prognosis not only with reference to life, but with reference to the probability of severe and lasting injury to the nervous system in its relation to certain vital functions and also the probability of serious deformities, which may by prompt and rational treatment be wholly or in part averted, but which at a later period are extremely difficult to overcome. Of prime importance in the treatment is the necessity of making the involved portion as nearly as possible aseptic.

To accomplish this, the clothes having been removed in a warm room, all blebs should be punctured, shreds of clothing and other débris carefully removed; the surface carefully washed and mopped with some mild germicidal solution, preferably borosalicylic solution, or the standard Thiersch's solution, the whole carefully enveloped in multiple layers, first of borated lint and absorbent cotton, covered with rubber tissue, with either bichlorid or iodoform gauze, constituting the outer layers, held in place lightly

by a few turns of a roller bandage. Among the newer remedies applicable in these cases there is one much vaunted and very justly so. I refer to europhen, which may be used in the form of powder, gauze or a 3 to 5 per cent. ointment; with reference to the latter preparation (the ointment) while it is almost uniformly recommended, I seriously question whether its use is consistent with strict antisepsis. Europhen has the advantage over iodoform of being non-odorous, practically devoid of danger from toxic effects and, according to some authorities, is better than iodoform in promoting rapid healing, especially in suppurating cases. The exclusion of atmospheric air is a *sine qua non.* This was accomplished by the older practitioners in the use of applications of oil followed by layers of cotton batting. Since the antiseptic era, we know that these dressings constitute a nidus for the harboring and propagating of the various forms of bacteria. For the relief of pain and for its action in sustaining the enfeebled heart the use of morphia and atropia administered hypodermically is perhaps the best remedy to be employed. The use of ammonia, brandy, strychnia and camphorated oil is recommended to stimulate the heart before reaction has set in, but in my opinion in a large number of cases the judicious use of morphia and atropia is most satisfactory. For the relief of pain in superficial burns the use of bicarbonate of soda in solution as a topical application is strongly advised and in many cases where more elaborate treatment is impossible this is *par excellence* the treatment to be employed. The dressings should not be changed too frequently unless the character of the case necessi-

tates the employment of special measures, such as the application of silver to redundant granulations, stimulating applications to promote the granulating process, skin grafting, special posturing, the use of splints or other retentive apparatus to overcome a tendency to cicatricial contraction.

Thiersch's method of skin grafting is probably beyond comparison the best, when such means are indicated. One of the commonest mistakes made in cases of severe burns is the neglect to use the positive means within our power to prevent cicatricial contraction. The tendency to this contraction, especially in the flexures of the joints, should be constantly borne in mind. The great difficulty in overcoming a deformity of this character by operative procedure at a subsequent period, and the comparative ease with which the deformity can be avoided, justifies us in severely condemning the surgeon who from carelessness or want of proper knowledge allows it to occur. It is true these contractions to some extent occur in deep burns, in certain localities, in spite of the most skilful attention which can possibly be rendered. Pains-taking care in the management of granulating surfaces, stimulating them when necessary, and hindering their too rapid growth, the transplantation of skin, fixing the position of the parts with a view to antagonizing the constant tendency to contraction, are all means which, when intelligently made use of, are calculated to get the best result. After the formation of a new skin, massage frequently and systematically applied together with a reasonable stretching are useful adjuncts.

In these cases constitutional measures should be

adopted according to indications; this includes looking after the alimentary tract, the nervous system, the use of general tonics, good food, bathing and outdoor exercise as soon as permissible.

The prognosis in cases of burns and scalds varies with reference, 1, to the degree and extent of the injury; 2, with reference to the age, sex and individual peculiarities of the patient, together with the manner in which the accident occurred; and 3, the surroundings of the patient during the progress of treatment, the time when the first assistance was rendered and the intelligent application in detail of approved methods.

CHAPTER IV.—FRACTURES AND BONE TRAUMA.

FRACTURES OF THE FEMUR.

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The subject we have before us may justly be considered a trite one. It is one with which we are all apt to have experience of one kind or another. Some we may call fortunate, others unfortunate experiences.

With the advent of the penetrating X rays it behooves all surgeons to make a special effort in the diagnosis and treatment of fractures of the long bones.

My object in bringing this subject before you today is not with the idea that anything new or startling may be shown in the diagnosis and treatment of fractures of the femur. But my experience as regards injury to this particular bone has been more or less extensive, and I have a few observations to make which may be of interest to all. Surrounded as the femur is, especially at the upper extremity, by large and powerful muscles, there are times when it requires the utmost care and precaution on the part of the surgeon to determine definitely the existence or non-existence of a fracture. Under such circumstances we can not be too careful in our examinations if we would assure ourselves of a correct diagnosis, and a correct diagnosis is the only means by which an intel-

ligent prognosis can be given. I believe in all cases where it is difficult to observe after careful examination any definite sign of fracture, and the latter is suspected, we should insist on the administration of an anesthetic. With spasm relaxed we are often enabled to locate crepitus and in cases of impaction our measurements can more accurately be made. I have seen some very grave mistakes made by men who justly bear reputations as surgeons, which I am confident would not have occurred had their patients been examined under anesthesia. As regards fracture of the neck of the femur, I think that in most cases where such are suspected, an anesthetic should be given and the examination be thoroughly made. Due care should be used, however, to guard against the possibility of breaking up an impaction.

I have had unfortunately within the short space of a month in my own practice two cases which a careful examination without anesthesia failed to reveal what ultimately proved to be a fracture.

In one case I had in consultation with me one of the best surgeons in my neighborhood, and together we measured the patient carefully and could detect no shortening. The position of the limb was normal, rotating and flexing, although it gave more or less pain to the patient and failed to give any definite sign of fracture. Our diagnosis was contusion, and we told the patient he would be well in about ten days. This occurred about two years ago and the patient still uses crutches and has about two and one-half inches shortening on the injured side. The second case passed from my hands to the hospital, where under anesthesia a fracture was discovered.

No bone in the skeleton is more influenced by the action of the muscles and yet it is surprising often to see how little attention is paid to the importance of muscular contractions. In saying this I do not intend to convey the impression that surgeons of today treat fractures of the femur without in some manner or other extending the limb for the purpose of overcoming muscular contraction. But it has been evident from some of the results we have seen that an effort has not been made to overcome muscular contraction in a scientific manner. Our efforts to overcome muscular contraction by extension should be directed against those contractions as they are liable to occur. Several muscles whose combined action tends toward one direction displace the fragment. It may or may not be possible to use extension sufficient to overcome these contractions. We have besides the situation of the fragment, another factor in the peculiarity of the patient. This latter in my opinion is more important than is usually conceded. We see some with the proverbial muscles of iron, the degree of contraction necessarily being in proportion to their tonicity. It is quite reasonable to understand, therefore, that a fragment of bone likely to be displaced by an ordinary muscle is likely to be more displaced by one exhibiting stronger powers of contraction.

We use extension to overcome the contraction of the long, powerful muscles of the thigh, or in other words, to overcome the muscles displacing the lower fragment. We elevate in the hope that we may bring the lower fragment in apposition with the upper.

Before we would enter into an intelligent discussion of the treatment of fractures of the femur, it becomes

of utmost importance to review the pathology as it generally occurs. I think that fracture of the shaft at the upper one-third offers the most advantageous means of applying our knowledge for the bettering of the patient; and for that reason principally, and also in order not to infringe on the time of others here, I will confine my remarks on the pathology to this particular form of fracture.

Recall for a moment the anatomy of the upper one-third of the femur and we find an abundance of muscular attachments so that at first thought it would seem difficult to determine the exact direction the upper fragment is most liable to take in complete fracture just below the lesser trochauter. By dividing the muscles into two groups, one set being posterior, the other anterior to the great trochanter, we have a simple and exact method of determining the position of the upper fragment. We find, however, that the action of the posterior set of muscles is not in proportion to offset the action of the anterior, partly due to the nature of the muscles themselves, the larger ones acting as a cushion to the bony parts, rather than as a powerfully contracting tissue to assist in the movements of that portion of the body, and partly also due to the relative points of insertion. The fragments being acted upon as a lever of the second class, naturally the muscles inserted at the lower point exert a more powerful influence on the movement of the fragment. When a complete fracture occurs just below the lesser trochanter, the contraction of the psoas magnus and iliacus are exerted to such a degree as to almost entirely overcome the action of the glutei and remaining posterior set of muscles. The

usual result is the tilting upward and rotating outward of the upper fragment. The lower fragment naturally slips behind and the contraction of quadriceps, extensor, adductor, gracilis, biceps, etc., causes the lower fragment to draw upward, the result being shortening of the entire limb.

To illustrate this I have with me an excellent pathologic specimen. It represents a fracture at the upper one-third of the shaft just below the lesser trochanter. This specimen emphasizes the necessity for elevation and extension if we would have the fracture unite on a straight line and not have a result of two and one-half inches of shortening.

I have no history of this case, but it is quite apparent from the result shown here that the fracture was treated without elevation or extension.

It is quite evident that the upper fragment was drawn forward by the psoas magnus and iliacus, and that the lower fragment was drawn upward by the long powerful muscles of the thigh. As this was a complete fracture and directly transverse, I see no reason why it could not have been properly reduced under complete anesthesia. With muscles relaxed and elevation and extension applied, it might have resulted in a perfect union of the fragments without shortening.

One question as regards the treatment of fracture of the upper one-third of the shaft of the femur, has I must confess, often puzzled me, and that is, what is the proper amount of elevation to use in order to have the lower fragment in apposition with the upper, or at least to have the shaft of the lower fragment take the same direction as the shaft of the upper fragment.

We know that in the case of children good result

have followed the raising of the entire limb to a vertical position or at a right angle to the direction of the body. Fairly good results in adult cases have followed the use of the double incline plane with Buck's extension where we have a much greater angle, and I have seen good results follow the use of the Volkman slide.

I think it is a well known fact that the best results have been obtained in young patients; various reasons are given, but to my mind the increased amount of elevation is one of the most important factors.

I do not think it essential or advisable in the case of adults to elevate the limb so as to place it in a vertical position or at right angles to the body, but I do claim from the pathology of the fracture that in the great majority of cases more elevation is required than is generally given.

One object we have in making extension and that is, not that the entire limb may be as long as before, but that it may not be shorter than its fellow. I recall a case in particular which aptly illustrates my meaning. A young man, age 19, acting as a brakeman on a freight train, was brought to the hospital with fracture of the shaft of the left femur, and who had at the same time a fracture of the acetabulum of the right hip. We were confronted with an irreducible dislocation of the head of the right femur and an oblique fracture of the shaft of the left. An attempt to make sufficient extension on the left side to reduce the amount of shortening to a minimum would, without doubt, have resulted in a longer limb for the left than for the right. Hence, although our results might have been more perfect as regards the union of the

fracture, yet it would have been less acceptable to the patient.

By simply steadying the right side by means of sand bags so arranged as to keep the line as near like the original as possible, and by using a double incline plane without extension for the left side, we obtained ultimately a good result. For although the patient was perhaps a little more than two and one-half inches shorter in stature than before, yet he was finally enabled to walk with scarcely any appreciable limp.

In my hospital service I noticed that nearly every patient treated with the Volkman extension apparatus complained constantly of pain in the heel. I tried every imaginable way to relieve the pain and have the extension continued, without success. This was particularly the case with the small boys who invariably tried to reach the foot of the bed, and thereby defeat the purpose of extension. Having had occasion since then to treat several boys for fracture of the femur, I succeeded very nicely with a modification of the Volkman slide.

First, I removed the metallic splint and foot rest, I had the little patient's stocking and shoe put onto his foot. The stocking was cut off at the shoe top, so as to leave the leg bare. Then with some adhesive plaster I strapped the shoe and leg as high as the knee, then a screw was inserted into the heel of the shoe to which was also attached a transverse piece of wood to slide along the board beneath, and to assist in keeping the foot upright. A cord was tied to the screw and extension weights attached. All of those treated in this manner never once complained of pain in the heel. In this way I was able to use more extension

weights without distress to the patient. The results, I am happy to say, were very gratifying.

One word I wish to say in regard to fracture of the femur occurring in elderly people. I think it is our duty to have these patients able to leave their beds as soon as possible, and to this end I do not think there is a more serviceable appliance than a spica made of plaster of Paris, always carefully padded with cotton.

In the treatment of compound fractures, I think that, wherever it is possible, they should be converted into simple fractures by thoroughly cleansing the opening, closing with sutures if need be, and healing with an antiseptic dressing. I have seen some excellent results follow this method of procedure, and am heartily in favor of it wherever it can be done.

DISCUSSION.

Dr. M. GARDNER—It has been my fortune to see a number of ununited simple fractures in the right limb, and I do not know whether other surgeons and employes of the companies have met with these cases; we have had three on our system in two years; they have been in the hands of good surgeons, men competent to attend to business, but union did not take place, and the result has been we have been obliged to make a compound fracture and wire it.

Dr. COLE—I have had three cases of ununited fracture of the femur, two of them I wired without satisfactory result, and I would like to know—because that is a mooted question in the profession—the experience of those who have had these cases as to the results obtained in wiring ununited fractures of the femur.

Dr. GALBRAITH—I call to mind a very interesting case: A conductor sustained a simple fracture of the thigh, I forget which leg now; he was placed in a hospital and treated by a a very good man; the usual methods were employed, but he failed to get union. He cut down and wired it and put it in a plaster-of-paris dressing and it remained some ten or twelve

weeks; there was no tendency to repair, the splint was replaced and remained about six weeks I think, and after removing the splint on examination it was found there was a false union; it was a railroad case, and the surgeon wrote me concerning the man's condition, and a little later, probably two weeks, I visited his hospital and advised cutting down and sawing off the bones and using Wyeth's device in the usual method; the limb was put into a plaster-of-paris cast, at the end of ten weeks the dressing was removed and we had succeeded in getting an excellent result; and I believe invariably the use of this in the thigh, and more especially in the leg, is much better than the wires or any other strong suture; I think better results will be obtained by its use than by any other method; it certainly holds the bone in better position and maintains better apposition and rest to the parts. The great difficulty in those cases where wire has been used, is that the regenerative process that goes on is so violent as to be continuous and resolution does not take place till so late that the callus becomes softened.

Dr. LEMEN—I have had varied experience with the cases that I have used wiring. I must say that it has never been very satisfactory to me. I find that where you have to cut down and wire in ununited fractures, it requires at least twelve weeks of immobilization before you can expect union; the patient becomes impatient and the surgeon becomes impatient; in a case that I have had recently I kept it up for thirteen weeks and there was as much of an artificial joint at the end of that time where I used my wire as when I began. I had another case in which there was a compound comminuted fracture of the femur; the laceration of the soft parts was very extensive, and one portion of the bone was split off from the other two between three and a half and four inches long. I did not have to do much cutting in that case because the external wound exposed the interior wound completely. After washing it out thoroughly instead of using wire I simply took silkworm gut and put it around in three or four places, binding very much as the old farmer binds his sheaves of wheat, and I never had a better result in any case. I believe instead of using the silver wire, unless the fracture is almost transverse, and it is a very rare occurrence in my experience to have

an ununited fracture of the femur where it is almost or completely transverse, if the first cardinal principle which should be regarded in the treatment of the fracture, is observed, simple apposition, the muscles themselves retain it in position; an oblique fracture gives the most trouble and is the one most likely to be ununited. In any oblique fracture of the femur where it is necessary to use wire you can use the silkworm gut; I put it entirely around the bone, periosteum or anything else, bring it as tight as I can, tie it in three or four knots, dress with aseptic dressing, immobilize it. The great reason that we have ununited fracture in most of the cases is that we do not immobilize our fractures, and as I have stated to our Society for two or three years, the treatment of fractures of all kinds is the simplest thing; there are three cardinal principles that should be observed and we will rarely have bad results; the first is, diagnosing—make out the fracture and the condition of affairs; the second is apposition; the third the retaining in apposition—and your results should be perfect.

Dr. Reed—I want to add one more cardinal principle which is highly important in the repair of fractures, and that is we must have in addition to apposition and holding in position, the disposition on the part of the economy to repair. I remember a case which was injured on the Baltimore & Ohio railway some twelve years ago in which there was a transverse fracture which I knew was properly adjusted and held in apposition because it was placed in the hands of one of the best surgeons in that section of the country, in which there was no repair whatever, that was operated on, and still no union, the subject of which sued the company for damages; and the company had to pay a good many thousand dollars in that case. I began to feel that something had been left undone, something that I ought to have done. After-experience has taught me that in those cases where there is non-union it is nine times out of ten the result of the failure on the part of the economy to repair the bone, except in those cases where there has been a portion of the connective tissue or muscles interposed between the ends of the bone. I have operated on quite a number of cases for non-union and in, I will say at a rough guess, perhaps 50 per cent. of those cases there has been

an interposition of connective or muscle tissue in between the end of the bone, and when that is there there can not be union; but on the other hand when there is no foreign substance between the ends of the bone it is due to a lack on the part of the economy to replace new bone, and when that is the case I do not care whether you wire the bone or whether you hold it together with silkworm sutures or what you do, it will not repair. In a number of these cases in which we have made careful union, in which we have sutured the bones together with various sutures, we have had no repair whatever, no disposition to repair. One case I recall: The fracture had been immobilized for ten or eleven weeks, and in cutting down we found no disposition to repair whatever; it was like an entirely new fracture, not even absorption of the end of the bones; it is not the fault of the surgeon, but the fault of the economy or the tendency to repair in the person who is injured, which should be taken into consideration; and I believe in a large majority of these cases where there is non-union it is often the fault of the persons themselves, not what they do, but a constitutional condition which prevents the repair of the bone.

Dr. HERNDEN—The remarks of Dr. Reed call up a point in my mind and that is the failure on the part of nature to provide for the repairs. I believe myself, from some experience in that direction, that is true, and I would like to speak of a case in particular which will help the author of the paper. We all feel sympathy and admiration for the fellow who owns up to the corn. I wish to speak of this case because I fully agree with him? It was a peculiar case. A wealthy man in our vicinity, and in fact about the only one we have around there, was visiting in Minneapolis, and fell through a skylight in the hotel, the skylight to the library, struck on the steam radiator; he was severely shocked and it was thought he would not live—and I think the condition of shock is a barrier in the process of repair in a fracture wherever received; he received a compound comminuted fracture of the forearm; he also received a fracture of the thigh or femur. Dr. Hague of Minneapolis, an eminent physician, and a professor in one of the colleges there, were called and diagnosed an intra-capsular fracture of the hip, and put him under treatment, carrying out

immobilizing of the hip joint and the whole body for about a little over two months and then declared that there was a repair of the fracture. Dr. Hague wrote to me subsequently that the case was one of those unusual cases where recovery had been achieved where the fracture had occurred within the capsule. The man got homesick and came home on a bed. The doctor had taken off the immobilizing appliance but had a weight and pulley still attached to the limb, because he wanted to maintain his glorious result—the doctor wrote he had achieved a result that was remarkable, he felt proud of it, and wanted that I should keep up the extension so there should be no shortening—and there was no shortening that I ascertained on examining the man. I took off the weight and pulley, threw the weight over the bed and told him, "You never had any fracture of the capsule, Dr. Hague to the contrary." On examination the joint was soft, weak and exhausted, the fracture in the arm had not healed nor the bones united; this delayed the fracture of the arm, and the fracture existed in the thigh, not the hip. I speak of this to emphasize this point that the processes of repair may be delayed by shock or other systemic condition. On examination I found no shortening, but I found a splitting fracture of the thigh, commencing at the trochanter extending down eight inches. I could pass my fingers—he was thin—between the fragments and push out the lower end of one fragment. Not being content to let the diagnosis remain with myself pitted against Dr. Hague and the professor, I called in three prominent and competent surgeons. They agreed with me. I made an appliance holding the fragments in apposition and got a good result under heroic systemic treatment. I wrote to Dr. Hague and gave him what I thought was the history of the case from the beginning. I said, "You have not achieved a grand result, you have achieved a grand sort of ignorance." He sent me the affidavit of the Professor stating that there was crepitus, no doubt about the fracture being in the capsule, I was a foolish man to speak of the splitting fracture, I was simply stating something that did not exist. We had some more correspondence about it; I wrote him that the surgeons that examined it were eminent, and the four of us concurred, no question about it, and each of us passed our fingers under the fragment of bone. I said, "That is where you

got your capsule—it never was an intra-capsular fracture." I have brought up the case to emphasize the point made by Dr. Reed and to help our Dr. Dooley as to the diagnosis in such cases. I have myself been very much bothered sometimes, and I think Dr. Hague and his friend must have been bothered when they made that diagnosis.

Dr. MAYO—In reply to Dr. Cole's inquiry in regard to wiring fractures I would say that in one case of ununited fracture the result was unsatisfactory. In a number of instances I have wired compound fractures, or at a secondary operation wired for the relief of deformity due to improper union. One fault in wiring is that while you can hold the ends of the bone in position, muscular action has a great tendency to cause angling or bowing, which is hard to prevent. About a year ago I saw a silver bone splint in Baltimore, used both by Tiffany of the University of Maryland and Halsted of Hopkins Hospital. This splint is composed of silver, is about three-fifths of an inch wide with screw holes at frequent intervals. A piece of this splint can be broken off the right length, laid so as to cover the seat of fracture, and on the sound bone each side, and with silver screws firmly anchored in position. It is claimed that this can be sealed and left permanently. A recent case is reported in the *Annals of Surgery* where this was done successfully in a case of ununited fracture which had been previously operated upon several times, with failure. I have used this on one case with great satisfaction; the case was a septic one and I packed with iodoform gauze and eventually removed the splint. I was surprised on removal to see how tightly the screws were held in the bone at the end of a number of weeks.

Dr. SCOTT—I wish to say a word on Dr. Reed's remarks relative to the nutritive influence in connection with fractures, especially in fractures of the femur. I think a great deal more attention should be paid to that especial point by the railroad physician than is usually given. Recently, upon my recommendation, the general manager of my road has taken steps for the purpose of employing a better class of labor on our road. We have heretofore had no examinations made scarcely, and while we have had some examinations made in the transportation department, we have not had any in the road department, and have had a great many fractures from that department;

our general manager has given instructions that the foreman or the road master should employ none but comparatively young, able-bodied men. While that seems to be an injustice to the old class of laborers, yet it is nothing but justice and is a protection to our company to employ such laborers. I believe that on account of this step we will be saved some of this trouble and it may save the company thousands of dollars at the same time.

Prof. RIDLON—When the general surgeon treats a case of fracture and fails to get union, and wires it and fails to get union, he sometimes comes to the orthopedist for help. That leads me to feel I have some right to take a part in this discussion. There is one point omitted in the question of treatment for repair of fracture. As I understood Dr. Reed's point of defective nutrition, he means defective generally and not local. I should take exception if it were defective locally.

Dr. REED—It may be either or both.

Prof. RIDLON—I will cite two cases: Henry D. Sands of New York; treated for fracture of the tibia, non-union; he was wired, non-union; then afterward it was operated on by Dr. Frank Hartley of New York, and failure to get union; he was sent to me. I took off the splint and in six weeks there was good union. The other case was treated by William T. Bull of New York City; there was a local defect, not general; after wiring and getting no union, the case came to me. I took off the splint and treated it and in four weeks there was a good solid union. The point I would make is this: These cases, and all the cases I have happened to see, have been treated by plaster splints. I would not say that plaster splint makes non-union, but I say in many cases of non-union the effect is due to constriction of the fractured region. When the constriction was removed, when the local congestion was reduced at the point of fracture, union took place. I believe a fracture should not be constricted.

Dr. GALBRAITH—In view of the fact that our discussion is placed on record, I wish to take some exception to Dr. Lemen's remarks; possibly I did not understand his meaning. If my memory serves me right, he cited the fact that all there was to do was to secure and maintain apposition and that in all cases you would secure a perfect result. Now I may be in error in

this; if I am I will go no further. If I am correct I should like to say something concerning his treatment.

Dr. LEMEN—I think you understand me correctly; my statement was this: Diagnose your fracture, place it in position, retain it in position, trust to nature, your results are perfect.

Dr. GALBRAITH—I will cite a case and I will be much obliged if the gentleman will advise me regarding the treatment. A lady, 18 years old—she is under my care at the present time—met with an accident in a railroad collision, receiving a fracture of the right clavicle near the shoulder joint, a fracture of the left clavicle near the middle, a fracture of the scapula, a simple fracture of the middle portion of the humerus and a compound fracture of the elbow joint. Repair has taken place at all seats but the third of the simple fractures; there was a rupture of the muscle and I have some deformity of the clavicle and scapula and a non-union at the point described. And I would like to know in a case of this kind, how any man can apply a dressing, how he can secure a perfect apposition and maintain it by any surgical dressing or surgical appliance? The great difficulty in making positive statements of this character is that we may in a short time be confronted, as oftimes happens when a railroad is sued, with the statements especially of an able man like Dr. Lemen; he is an able surgeon and inasmuch as he has taken this positive stand how can we avoid conflict when we are not having the best results in practice?

Dr. LEMEN—There is just one remark that I would make in addition—and yet I doubt the propriety of making it a matter of record—but I have always looked first upon science and results to be the first consideration, the first duty in the position that I have always occupied, and I do not feel that I should have my views, honest convictions restricted for the mere fear that perhaps it might not suit the railroads or the selfishness of the other corporations that I might work for. I believe we should rise above these things; we should stand upon a higher plane than to allow for one moment the position that we occupy toward a corporation to prevent us from righting ourselves in regard to scientific facts. I perhaps am a little more outspoken than the most of men, but it is due to my bringing up and I perhaps can not help it—built that way.

Dr. GALBRAITH—I do not think the Doctor understood the gist of what I wanted to convey. It was not for the protection of the corporation nor the individual, it was the protection of the surgeon himself. I have a deformity in this case and a non-union, and I do not know how anybody could overcome the difficulty and secure better results than I did; certainly could not apply any dressing, could not secure apposition, on account of the serious complications and multiple combination of the fractures. It was not for the purpose of protecting any corporation—it was simply the individual. I do not feel I am responsible for the result I have got in this case. While the deformity is slight, there is some.

Dr. LEMEN—I believe that it is true in our profession as well as others, there is an exception to all rules and the exception very often proves the rule. But I was speaking about general results.

COMPOUND COMMINUTED FRACTURE AT THE KNEE—REPORT OF A CASE.

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Compound injuries of the knee have at all times been considered most serious in character, more especially when complicated with fracture; in the latter the knife and saw have been considered indispensable, their absence fatal to the life of the patient.

Thus Erichsen (System of Surgery) in speaking of this class of injuries of joints, says: "This is more especially the case when the knee is the articulation injured; extensive laceration of this joint, more particularly complicated with dislocation or comminution of the bones, being cases for early amputation." Later Dr. Ashhurst (International Encyclopedia of Surgery) in discussing "Conditions calling for Amputation" places it more mildly by the remark, "Compound fractures into the knee joint may be considered a cause for amputation," yet when taken in connection with the text may almost be considered imperative.

Since the days of antiseptics, which may not inaptly be termed the New Surgical Dispensation, surgeons have become bolder and conservative treatment has in a measure supplanted the more radical, with varying degrees of success. Each successful case undoubtedly carries with it one or more practical points; and, if

the report of the following accomplishes that purpose, the object of this paper will be fulfilled.

S. M., aged 38, Finn, laborer, married. On March 13, 1896, while at work at the base of an ore pile on the P. & C. docks at Conneaut Harbor, about 2:30 P.M., was injured by a mass of frozen ore which rolled down the side of the pyramid and caught his left knee between it and an ore bucket. He was at once conveyed to his home about half a mile distant, and surgical aid summoned. On arrival found Drs. Baker and Tower present. Told them I had been requested by an official of the company to take charge of the case. Had been telephoned for and word returned I could not come, which was a mistake and accounted for my tardiness, as I had only a few moments before received word. Patient was under chloroform, and the doctors assured me that "the head of the tibia was comminuted and the joint open, that finger could be readily passed into the joint through the external wound and fracture plainly felt; that they had adjusted fragments and sutured external wound." By palpation the diagnosis of comminuted fracture was readily confirmed, the head of tibia being broken into at least three pieces; also dislocation of head of fibula with transverse fracture of shaft about an inch below. Inspection also revealed a wound on extero-posterior surface, along lower border condyle of femur, some three inches in length. After explaining to friends the serious character of injury, that amputation might be required, etc., was willing to make an attempt to save the limb, and so decided. The wound was dressed with iodoform gauze, limb placed on a double incline plane well padded with sublimated gauze, and a padded Levis splint anteriorly, bandaged, and patient conveyed to bed. Morph. gr. ¼, to repeat as necessary. Corrosive sublimate solution was freely used from first to last.

8 P.M. Knee and limb swelling, making bandages tight, considerable pain. On removing bandages blood welled freely from wound, which was gaping and stitches tense. Hemorrhage was readily arrested, parts cleansed and redressed. Ice bag applied over knee, which was protected by a folded towel placed underneath bag.

14th, 9 A.M. Still oozing, swelling increasing, limb inclined

to roll inward, pain severe notwithstanding morphia. Complains bitterly from slightest motion of the body, evidently splint not meeting requirements and some other device loudly called for. Redressed wound and adjusted as well as possible, ice bag continued.

2 P.M. Assisted by Drs. Tower and Baker, removed double incline plane, bathed limb thoroughly, cor. sub. sol. not forgotten, and placed in a Smith's anterior wire splint with a foot piece; adhesive strips applied to sides of leg and fastened to foot piece in the ordinary way for extension, splint extending

FIG. 1.—Appliance for support of fractured knee.

over fully two-thirds of thigh, limb being supported by a continuous series of strips of a common roller bandage 2½ inches wide, whole length of splint, fastened upon either side by pins and then suspended in a Salters cradle. Sutures removed and wound drained by iodoform gauze crowded well into joint, over which was placed iodoform gauze and sublimated cotton, held in position by the strips of bandage supporting limb. Ice bag replaced and morphia as necessary.

15th, 10 A.M. Very little pain since yesterday P.M. Pulse

90, temperature 99.6, tongue coated, bowels inactive, enjoys his pipe, had a fair night. Wound oozing, dressings soiled. Comp. cathar. granules (Whitbeck's) ii, repeat in evening if necessary.

16th, 9:30 A.M. Pulse 90, temperature 99, no action of bowels. Comp. cathartic pills ii every six hours until bowels move.

17th, 9:30 A.M. Pulse 90, temperature 99.6, a costive movement of bowels. Soda et potass. tart. a tablespoonful once in four hours until proper action secured.

18th, 10 A.M. Pulse 90, temperature 99.

19th, 9:30 A.M. Pulse 90, temperature 98.6.

20th, 10:30 A.M. Pulse 90, temperature 98.4. Outer dressing to wound unsoiled for first time.

21st, 10:30 A.M. Very comfortable. Ice bag discontinued.

22d. In redressing wound omitted drainage.

23d. Very little swelling of knee.

25th. For past two days had had a severe pain in middle third of leg, commencing about 5 P.M. and continuing into the night. Pulse 80, temperature 98.4, tongue coated, hydrarg. chlo. mit. gr. ss. once in three hours for three doses (from which bowels moved thoroughly), quinia sul. gr. ii every three hours. Quinia continued for two days with complete relief.

April 15. Wound closed.

20th. Osseous union fair, motion of joint more than expected, flexed and extended knee quite a number of degrees. Limb heretofore kept slightly flexed, readily straightened. Bathed thoroughly and placed in plaster Paris cast. On the next day (21st) to my surprise found patient dressed, sitting in a chair. He at once commenced getting about on crutches and progressed rapidly.

May 3. Complained of pain in lower third of leg, inner side. Cut off cast, and union appearing good, omitted splint of any kind, simply a cotton compress and bandage. Motion from extreme extension to very near right angle.

The pain continued, sometimes in leg, at others in foot, or in both, of a very severe character, notwithstanding treatment, which was both general and local; among the latter liniments, blisters, cupping, massage, etc., until July 2, when an interrupted galvanic cur-

rent was used with marked relief, repeated on the 5th, and no complaint since, although it was again used on the 13th. At latter date motion was nearly complete, and used only a light cane in walking.

There is a little deformity on outer side, owing to excessive callus formation and undue prominence of head of fibula, otherwise the result is as complete as could be wished.

FIG. 2.—Support for fracture of knee. Bandages loosened for dressing wound.

In reviewing the management it is unnecessary to comment on the strict antisepsis which was maintained, the drainage or antiphlogistic of cold as applied by the ice bag. To do so would only be to repeat what has oft been reiterated heretofore; but to the mechanical device, which, to my mind, proved a strong link in the chain leading to the result, I wish

to call special attention, not that there is anything in it new or original, for there is not.

The Smith wire splint, with the attached strips of bandage as applied, afforded a bed and support to the limb, held it firmly and secured perfect rest and repose for the injured parts. The facility or ease by which the wound could be reached was also important, to accomplish which we had only to loosen a couple of the strips upon that side, turn them back underneath, or if soiled remove entirely and replace with new, take away the dressings, which were then entirely free, bathe, or do whatever necessary, apply fresh dressings and readjust the strips, all without any handling or moving of the limb whatever; a great convenience, as it was deemed advisable to redress at each visit for some ten days, on account of oozing, and at longer intervals thereafter until healed. Pus was not at any time visible. Strips were carefully examined each day, to see that each remained properly adjusted, or all bearing equally. When we desired to inspect the sides or posterior surface at any point, we loosened one or even two strips on one side; if more desired, readjusted ones already loosened, and proceeded as before. For the anterior surface, simply lifted the covering which had been folded and loosely laid thereon.

By the Salters cradle, in which it was suspended, extension was maintained by the heft of the limb and the pitch of the incline, and thus kept uniform. If the patient moved up in bed (he could readily do so himself unassisted), or if from any cause slid down, the pulley automatically rolled up or down the incline, creating no disturbance. When the patient was moved to

the right or left, the position was immediately accommodated by the swivel by which the cross bar was attached to the pulley, thereby affording quite a range, or even allowing the bolstering of the patient without the least inconvenience.

By the cord and hook in the ceiling, or a gallows placed by the side of the bed, the extension is maintained by the obliquity of the cord. If increased, then extension is increased; if lessened, extension lessened, until at the perpendicular it becomes null, and if perchance it passes beyond, then we have a crowding; therefore, to have uniformity of extension by this means, it is necessary to secure your patient against any sliding up or down, a very uncomfortable thing for him, but not required by the cradle, hence its advantages. The cradle I have found of inestimable value in severe injuries of the leg necessitating confinement to the bed, no matter what kind of splint was used.

It will be noticed that with the exception of April 20. when passive motion was made simply as a test, the joint was kept in perfect quietude until the removal of the plaster splint, May 3, after which patient was instructed to gently exercise it each day—another refutation of the idea of motion, either passive or otherwise, being essential against anchylosis.

DISCUSSION.

Dr. Scott—I happen to be one among the number who believe it is all right to use chlorid of mercury in the joints. While that practice is condemned by some of the leading surgeons, I believe it is justified under certain circumstances, and I believe as a railway surgeon in using chlorid of mercury in the joints. I have used it in the cranium and I believe it can be used in the joints. When we consider the fact that a majority of the wounds which we have to treat in joints are infected

when we are first called to see them, full of dirt and various foreign substances, and owing to the fact that we may have some difficulty in removing all foreign substances, all sources of infection, it is justifiable to use an antiseptic for the purpose of destroying those germs that remain. I believe it is good principle and good practice all the way through, and as I said a moment ago, I presume the Doctor's treatment was successful largely on account of the fact that he used drianage and the wound was fortunately situated for the purpose of getting good drainage. In a similar case of my own, a young physician—a young homeopath, by the way—who was afflicted with pulmonary tuberculosis in an advanced stage, but continued the practice of medicine, while whipping his horse one day was kicked on the knee, and the result was a compound comminuted fracture of the tibia which went through the skin and the synovial membrane about an inch and a half long; the lower half of the patella was simply pulverized. I was called to see the man in a short time after the accident. On examination I found the injury I have described, also a lot of dirt on the wound; found some bits of underclothing in the wound, and having gotten him in proper place, I made the opening larger and irrigated the wound thoroughly; and by the way, I believe we can not clean a wound of this character without the use of water in a stream; I do not believe we can clean it by sponging or dropping or anything of that kind, but it needs a good strong stream of water to flow into the cavity in order to flush. I used the bichlorid of mercury, just as the Doctor has stated; after I got through I was not satisfied with the opening that existed in the joint, I stitched up part of it because it would not be of service to me, but I made two openings on either side near the lower part of the joint as far back as I could go, put on the drainage, left a piece of iodoform gauze to the front, placed the limb in an inclined plane, gave the patient a little medicine, I forget what; although he was a homeopath, I think I treated him by the usual methods—he did not ask any question about what he should have—and left him alone; changed the dressing every three or four days, but the result was something surprising, because I was afraid his pulmonary trouble would have some influence on the result. The patient, however, seemed to get no worse during the time he was laid up

with this injured joint, and finally made a good recovery, got excellent motion, hardly a bit of sepsis connected with the case. I think the good result in my case was due chiefly to the openings referred to, the excellent drainage and perfect cleanliness and antisepsis combined.

Dr. REED—I was very much pleased with the Doctor's paper and also very much interested in the remarks of Dr. Scott, but I must take some exceptions in reference to one point which each of them recommend, both in the paper and in the remarks on the paper, and that is in reference to drainage. I most fully concur with them that asepsis or antisepsis is one of the secrets of success in the treatment of joint injuries, as well as other injuries, but as to the use of drainage it is a question in my mind and one which I seriously question, except when you have something to drain. I do not believe drainage adds one particle to the recovery of an injury to a joint or to any other traumatism unless you have absolutely something that you want to drain. If you have suppuration of a joint, I should undoubtedly use drainage. But my experience is that the use of drainage in joint injuries is absolutely useless unless you have something to drain. I used to use drainage in almost every injury, whether of the joint or any other part of the economy, but during the last three or four years I have almost entirely discarded drainage, except when I have had a reason for it. In amputation of the limb I do not use drainage, further than the use of a little gauze for two or three days to assist by capillary attraction the discharge of the liquids as they accumulate, and after that take it away, and in the treatment of joint injuries—and I have had a good many—I have discarded drainage unless I have something to drain. If I adhere to the principles of asepsis or antisepsis I do not have suppuration, hence there is no use for drainage, and I believe you get along as well with asepsis or antisepsis and mobilization. Because when you have drainage you have an opportunity for the introduction of germs into the wound which you do not have if you do not have drainage. And so I must take exception to it, and I base my exception on personal experience as well as the experience of others who were at one time advocates of drainage and have discarded it.

Dr. E. WYLLYS ANDREWS—Admitting the tendency of mod-

ern surgery to abolish drainage, yet possibly it is not true that this applies to traumatism equally with the wounds which the surgeon makes in operating. The experiments of Robb and Schimmelbusch have clearly shown that we never really sterilize the skin in its deeper parts. In other words, while we may sterilize the surface of the skin so that it is not possible by mere contact to infect, yet that same skin a few hours later will be septic, because out of its glands material has been poured which carried with it microörganisms, therefore I must say as Dr. Reed has done, surgeons are drifting away from drainage as far as possible, because experience has shown that the moist serum about wounds in every case in twenty-four hours is septic. It is necessarily true that the wound becomes septic where the drainage tube comes out. Why should we assume from that that wounds made through dirty clothing or with blunt or sharp objects themselves septic, should not be subject to the same rule? The writer states that he did not open this wound for twenty-four hours after seeing it, probably because it began to show sepsis, and that would indicate immediate drainage, if not flushing. The knee joint is so complicated that it may almost be said to contain separate pockets, the bearing of which is that to drain a knee joint thoroughly a large number, or more than one opening is invariably necessary, as Dr. Scott has shown. In his case he found for complete drainage it was necessary to make two openings. In order to thoroughly drain a knee joint it is necessary to make several openings; exit must be supplied from six points: one each side of the patella above the condyle; one on each side of the lower border of the condyle, because fluid will gravitate there, and a pair of drainage or a single drainage tube will be necessary well above the patella.

Dr. Scott—Dr. Reed made the point that he never used drainage unless he had something to drain. I agree with him, and that is a good rule to practice in general surgery, but I want to make this point: in the knee joint we may have something to drain. Whenever we have a compound comminuted fracture involving the knee joint we have something to drain and if you stitch up your wound the opening in your synovial membrane may close up, you have a sufficient source of irritation there by way of traumatism to cause an outpour of the

synovial fluid, even if you have no blood, and you may have both. I believe, laying aside the question of direct infection or the danger of infection following, it is better for that joint that that fluid should escape, and you know it is good practice in simple inflammation of the knee joint to let out the fluid under the skin, and if that is the case in simple uncomplicated inflammation of the knee, why is it not good practice in injuries of this character to let that fluid out? I believe it is the best practice by all means to get that fluid out of there or give it free opportunity to escape.

Dr. Reed—I know that the Doctor has taken the ground which has been taken by many eminent surgeons, and a position that I have taken myself in the past but which I have discarded because I find I get along just as well and better without it. We admit that in a compound or comminuted fracture of the knee joint that we have or may have the blood serum, etc., exuding into the joint, but is it necessary for us to drain under all circumstances? Now I say I am in favor of drainage when necessary, but unless it is necessary I do not want to drain; for instance we have an involved joint lopping off of the condyle in the elbow, does any one think of opening the elbow in a fracture of that joint, and everyone must admit that in that fracture there is blood and serum in the joint. Nobody ever thinks of opening it; yet those cases get well without disturbance or interference of the motion because of immobilizing the joint; the patient gets well and we do not have much trouble with it. I take that as a cause for not opening the joint. If we take the Doctor's argument in question and say because there is blood and serum exuding into the synovial membrane this is a reason for drainage, when we have a condyle fractured and there is exudation of blood and serum we should drain, but we do not drain but depend upon absorption. So in any joint I do not drain and I have better results, unless I have septic material or something of that sort, that would cause a destruction of the knee joint. I base this on my experience, not for argument. I say in my experience in this line of surgery and in treatment of the injury to the knee joint I get better results when I do not drain than when I do, unless I have suppuration or something that is destructive to the knee joint which will not absorb.

Dr. WARD—It appears I have only been attacked on one part of my platform, and that is drainage. I use my drainage just as I do anything else; when I think it is called for I use it; if not, I do not. If in a given case I have a large amount of oozing, dressing completely soiled through every twenty-four hours, I keep it open; just as soon as it becomes reduced in amount to where I think it safe I remove my drainage and allow my wound to heal. The point also to which I desired to call attention was the appliance, the comfort and convenience of my dressing. I do not know of a man that has ever used such an appliance that would consent to use a double-incline plane for injuries of the leg or knee joint. I have not tried it in fractures of the femur, but I never put it on a person yet but what rejoiced in the comfort it afforded, after having had some other dressing upon the limb.

A NEW SPLINT FOR NASAL FRACTURES AND DEFORMITIES.

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This splint is intended for cases of nasal fracture in which there is a drawing upward of the point of the nose or of the alæ. Permit me to describe it by the narration of a case in which necessity demanded it.

C. W., boy aged 10 years, was brought to me, having been kicked by a horse several days before. The toe of the animal struck the nasal septum at its junction with the upper lip. The blow cut the septum loose from the lip. A wound extended through the septum from the point of union with the lip directly upward for three-fourths of an inch.

The detached edge of the septum was rolled up into the nose; both alæ were forced upward; the nasal bones were detatched from the maxillary and driven upward, and small pieces of the maxillary were broken on each side of the nose. The contractions of the levators of the nose held the soft and hard tissues where they had been driven by the kick. The point of the nose was far above its normal position; the right ala was much higher than the left.

The first step toward repair must be to bring down and fasten the septum in its position, the next to replace the fractured bones, the last to bring

down and retain in position the upturned nose. To fasten the septum by stitches was simple; the nasal bones were easily pressed into their normal position, but slipped outward as soon as manual pressure was removed. To bring down and *retain* the point of the nose in its proper place was impossible.

The best suggestion I could get from "the books" and experience was to draw the nose down by grasping its point, then to transfix the lower end of the septum antero-posteriorly with a long, stout, steel needle, the point of which was driven down in the palatal process of the superior maxillary. (See illustrations in Roberts' Surgery.) While this partially held the point of the nose from being drawn upward, it did so very imperfectly; the upward dislocation of the alæ was corrected but very little. The quite recent editions of Bryant, Keene, Ashhurst, Stephen Smith, Wyeth, Roberts, Ashhurst's Cyclopedia, Hamilton's Fractures, Holmes, Gross and Stimson offered no helpful suggestion.

After several days of chagrin over my inability to control the deformity, the very simple nasal appliance which I here present suggested itself.

It consists of a piece of No. 15 spring brass wire of suitable length, bent first into the form of a rectangular letter U, the arms of which are about an inch apart and long enough to extend from the center of the upper lip to the crown of the head or beyond that point; opposite the supra-orbital ridge a sharp angle is formed; this angle is to permit the splint to enter the orbital cavity just beneath the orbital ridge; this angle is a means of fixation of the splint against the

supra-orbital ridge and is one of the most essential features of the appliance. The lower end of the splint — i. e., the transverse portion — is carried forward, away from the lip, the distance of a half inch.

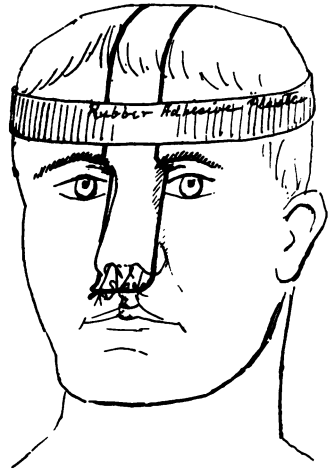
A continued narration of the case will best illustrate the application of the appliance: Having formed the wire splint to fit the head, forehead and nose of my patient it was applied to these parts; a folded piece of lintine was placed between the wire and the orbital ridge to prevent painful pressure at that point; the splint was held firmly in contact with the head with a broad strap of rubber adhesive plaster carried across the forehead and completely around the head.

The nasal bones, which could only be held in position by continuous pressure, were easily retained by pads of lintine placed between the splint and the side of the nose. A large, strong silk suture was carried through the septum near the point of the nose, the nose was pulled down by tying the ligature to the transverse wire beneath. The mucous membrane and cartilage (but not the skin) of each of the alæ were pierced by similar ligatures, and when drawn down to their proper positions the ligatures were fastened to the wire beneath.

The result in my case was eminently satisfactory though not perfection and was far better with this splint than it could have been by using any splint that has preceded it; indeed there *is* no appliance, so far as I can learn, that *can* perform the office of this.

I have recently added to the appliance a means of elevating depressed portions of the nose and permanently retaining them in position. It consists of a

wire of spring brass, bent so as to elevate the depression to the normal position by pressing upward from the inside of the nose. The wire should be covered with soft-rubber tubing; the stiffness of the wire should ordinarily be less than that of the outside splint. Each intra-nasal wire can be firmly fixed to the lower angle of the splint by a simple mechanical arrangement. This permits the intra-nasal wire to be removed from the nose and from the splint when



necessary to change its form or pressure. I have experimented with these intra-nasal attachments and believe that when properly fitted to the inner surface of the nose they will raise the depressed part and retain it in position more satisfactorily than any other device heretofore offered. The splints are manufactured by Chas. Truax & Co., 75 Wabash Avenue, Chicago.

Let me recapitulate the advantages of the appliance:

1. They are simple; the first described appliance can be made in a few minutes by any surgeon who has the wire and a pair of suitable forceps.

2. It is easily applied, remains permanently in position and permits the organ to be inspected during the progress of recovery.

3. It holds a compress firmly to the side of the nose when such are needed to correct deviations, an important matter in some cases.

4. It will draw down the point of the nose or the alæ and hold them firmly in their normal position. No other appliance for accomplishing this has heretofore been presented to our profession.

5. The intra-nasal wires, when used, remain where placed, a statement that is not true of the intra-nasal plugs ordinarily used, such as cloth-cotton, rubber tubes, etc.

6. I suggest the use of the intra-nasal splint in restoring the normal esthetic shape and overcoming the deformities of noses long previously fractured, after vicious adhesions and unions have been broken up.

DISCUSSION.

Dr. E. M. Dooley, Buffalo—I think, as I have served as a lay figure for the demonstration of this apparatus, it is my privilege to speak on this subject, and I would like to state for the benefit of those who have had no experience with the splint, that my experience was extremely pleasant; in other words, it was quite comfortable as long as I had it on—but whether the inside is as comfortable or not I have my doubts. But I think from my experience with broken noses, and owing to the locality in which I live I have had a great deal of experience with broken noses, and I have often been at a loss to have a splint that would do in any and all cases, and I feel very thankful to Dr. Hawes for exhibiting this splint, and I shall use it in the next case where I think it will be of service.

Dr. KIBLER, Cory, Pa.—Just one matter that occurred to me in connection with the splint, and that is—I am glad that Dr. Dooley testifies to the fact that the splint is a good one—could that part that enters the nose be made of hard rubber? It could be made more thoroughly aseptic and I believe give less danger to the mucous surfaces than you could have from the brass wire.

Dr. HAWES—It probably slipped your attention that that is covered with a soft rubber catheter.

Dr. LEMEN, Denver—As this originated in my neighborhood, Dr. Hawes being a neighbor of mine, and I was being occasionally asked to treat broken noses, he insisted that I use it, and I have used it in a number of cases and am very much pleased with its application; it holds the position of the bones perfectly. If the surgeon's apposition is properly attended to, the same is continued by the application of the splint.

Dr. COLE, Helena—It strikes me as being an extremely ingenious device. In the entire field of accidental surgery in minor matters there is nothing more troublesome, perhaps, than fracture of the nose with displacement, and to get a satisfactory result is sometimes exceedingly difficult, and if I understand rightly the application of this apparatus it should be a practical part of every surgeon's paraphernalia.

Dr. W. J. MAYO, Rochester, Minn.—I was very much interested in the splint of the Doctor, the external part I have never seen used in this connection. My brother, Dr. C. H. Mayo, has used a somewhat similar intra nasal splint in the elevation of depressed nasal fractures, and also a method of his own for the relief of sunken nose caused either by fracture or specific disease. In sunken nose he cuts obliquely through the septum and the depressed tissues behind and inside of the nose with a heavy chisel or cartilage knife, and elevating the septum introduces the splint, which allows sound union at a high level. In these cases the results have been excellent and continued so. The bevel of the cut surface enables the sliding upward of the depressed portion. The splint used by him consists of a similar piece of brass wire bent by a single turn into a coil, the two projecting ends being introduced into the nostrils, one along the floor, the other sprung up beneath the depression; the tension of the spring thus formed gives the necessary upward

curve, one splint thus constructed and covered with iodoform gauze being introduced into each side and left for a number of days.

Dr. Bryant, Omaha—I think this invention of Dr. Hawes for holding down the nose after an injury, not only the best splint I have seen, but the only one. I have never seen one for this particular purpose. The difficulty in a majority of the cases where injury to the nose has been received, is not to hold the nose down, but to raise it up—probably 90 per cent. or more would have a depressed nose, instead of an elevated nose; but this seems to be an all-round splint, not only to hold it down but to elevate it. If I were to criticise this I think it would be in the portion that enters the nostril, and that criticism is not anything of value; it simply would be this: In many cases, make it larger in order to keep it in, and that could be done by winding the copper with thread or string and then using soft rubber over that. I believe soft rubber is the best thing to prevent irritation of the mucous membrane, and I think this [indicating] might be uncomfortable after using it any length of time—that is, I think it would.

Dr. Hawes—In making some remarks upon the comments that have been made I come first to the comment that the inside appliance is uncomfortable. Any man that has ever had any experience knows that nothing is very comfortable in the nose; whenever you push up there a lot of cotton or cloth it is uncomfortable—but that has hardly ever been an objection during the years it has been practiced; it would be customary to use a wad of cotton, which is a thousand times more uncomfortable than the other, which is much more efficient. One of the other criticisms was on account of using a hard brass substance that was liable to corrode. That I reply to with the statement that in the paper it was stated it should be covered with a soft rubber catheter. I want to call attention to another fact, that I have presented to you two splints, the second is an outgrowth of the first; the second can be used for all purposes that the first was used for, the first can not be used for the purpose for which the second is. The first is intended to draw down the nose when it has been drawn upward; the second is intended to raise the nose from the inside, which is wholly outside of the field intended as the proper field of the first. Dr.

Mayo speaks of a method which I was not aware of; I have never seen it mentioned in the books. It is very evidently an excellent method of raising these depressed noses. This one of mine, while I have never had an opportunity to raise depressed noses, I have no doubt will do exactly what the other one does. The person who is using the splint should have some knowledge of the anatomic form of the inside of the nose, and should then bend his wires so that they should fit that form in particular, and raise the nose to its normal and esthetic position. The comment of Dr. Bryant that it should be larger can be very easily attained by using a larger catheter instead of the little catheter—I peeled off and threw away the rubber that I had on the outside when I began to talk, to show you the wire. By using the larger catheter you can adapt it on the inside to a nose of any size that you desire. Another of our members inquires, Where can I get these splints? I have stated in the paper that all you have to do is to get a piece of wire and a pair of pincers. If you want something better you might go down to any of the instrument makers, or even to the common tinsmith, and by giving your ideas, you might get it made in a very few minutes—if you go to the instrument maker it will cost you a dollar and a half; if you go to the tinsmith it will cost you ten cents. That is all.

THE PRESIDENT—Can the surgeon readily make that second splint?

Dr. HAWES—I made one; I am not a tinker or son of a tinker, but I made one in a bungling sort of way. This I took to the tinker and asked him to make it, and he made it rather better, shapelier far than I can; you would have to take that second one to the tinker or tinsmith or instrument maker. I do not think it is wholly perfect, but that it is an embryo of a valuable instrument, a valuable appliance.

Dr. REINEKING, Sheboygan, Wis.—I would like to make a suggestion in regard to the enlargement of the intranasal portion. I think that can be done and made comfortable by winding around absorbent cotton and dipping that in melted parafin which can be impregnated with an antiseptic solution; a backing of cotton cloth can be built up on the intranasal splint; the parafin is hard enough to make sufficient pressure.

Dr. HARNDEN, Waverly, N.Y.—I think it would be in order that a vote of thanks of this Academy be extended to the Doctor for bringing to our attention the valuable instrument.

Motion seconded and unanimously carried.

REMARKS ON THE TREATMENT OF FRACTURES.

BY R. ORTEGA, M.D.
CHIEF SURGEON TO THE MEXICAN INTERNATIONAL RAILWAY.
CIUDAD PORFIRIO DIAZ, MEXICO.

I want to talk about a treatment or practice which gives the patient entire relief at once from pain and puts him in good condition for work as soon as the fracture is solid. As soon as a patient breaks a bone I make massage from the lower part of the fractured limb to the upper part; we commence to do the massage very gently just on the skin, with anything, oil, or soap and water, salve or vaselin to allow the hand to rub without hurting. Ten or fifteen minutes afterward we do the massage on the muscles, always from the end of the member up, never making pressure; in ten or fifteen minutes after the pain is gone and we can reduce the fracture without chloroform or pain. As soon as the fracture is reduced we roll it in a simple flannel bandage, from the end of the member upward; if it is in the arm we put the arm in a simple handkerchief from the neck; if it is in the upper arm, the weight of the arm is enough to keep the fracture in good position. And the next day we do the same treatment, a little massage and a little movement in all the joints of the broken limb. I have done this treatment for a year. I have had but few cases as my practice is very small. One boy about 18

years old, had a wheel from which he fell and broke his right arm in the middle with a compound fracture, the upper end of the humerus projecting through the skin. Dr. Lord reduced this fracture, put on a good dressing and an apparatus, and he called the next day to see the patient; the patient wanted to cross the river. I saw the boy with Dr. Lord; we took off the apparatus, the wound was in good condition, aseptic because the doctor had put a very nice and good dressing on. I told him I was going to take off the apparatus as soon as I brought the boy over the river. I did so and then applied a bandage, and made motion in the elbow and other joints and in fifteen days this boy was at work as before the injury. There was a compound fracture of the humerus and simple fracture of the ulna, and in fifteen days later the boy recovered and worked as before, all the bones completely healed. I had one day two cases; one a small boy about 6 years old, broke the humerus of the right arm, not a compound fracture; I applied massage at once, and in ten days this little boy climbed trees and did almost everything. The same day in the shop, a workman broke his humerus in the middle, and the fracture was displaced, I did massage and put the fracture in position and rolled it in a bandage, and I left this arm without an operation; I did massage every day and about 20 days afterward this patient was in good condition. I do not remember the details of other cases, but I want to call your attention to this treatment. It gives a little more trouble to the doctor but that does not count; the patient does not suffer and is able to work very soon. My company does not give wages to people when they are sick

and I think this treatment is very good because it does not keep patients two or three months without working; they can go to work in 15 or 20 days.

REMOTE EFFECTS OF BONE TRAUMA.

BY D. S. FAIRCHILD, M.D.
SURGEON TO THE CHICAGO AND NORTHWESTERN RAILWAY.
CLINTON, IOWA.

Some experiences during the past few years has suggested the subject of this paper, and I have in consequence examined a considerable range of medical literature for the purpose of obtaining data upon which to base certain propositions. The result is somewhat disappointing for the reason that writers, even those standing highest as authorities, have written but little in reference to the remote consequences of bone injury, especially in relation to such cases as may become the subject of controversy. Exception must be made of the writings of those who before the discovery of the special cause of tuberculosis regarded certain classes of joint disease and certain cases of osteomyelitis as the result of injury more or less remote, recognized or assumed

The effects of injuries upon the future condition of bone tissue are so varying in their nature that it would be quite impossible to predicate the future possibilities in any case of trauma in an empiric manner based upon experience alone, but rather, in the first place, on well-known pathologic facts. The apparent relation of cause and effect in medicine are, as is well known, so often misleading that a most critical application of facts, derived from a close

study of pathology, becomes necessary to protect the surgeon from falling into serious error. So many writers on medical, as well as on other subjects, have fallen into the habit of loose and indefinite statement, that it is not difficult to find that the highest authority may be used in the support of propositions, often no doubt, quite in discordance with the author's real views.

It is true that unusual difficulties lie in the way of certainty in medicine from the fact of the complex nature of the subject and of the unforseen accidents which may arise to complicate the course of events, but much of this may be avoided by the employment of critical methods of study. The primary consideration in the study of the subject of this paper must be the influence of injuries in producing bone inflammation.

It is generally agreed that contusions of bone will produce swelling of the periosteum from extravasation and if the injury is sufficient or of such a character as to influence the bone an osteoplastic process will follow. It may generally be expected that resolution will take place in a short time, and that the periosteum and bone will be restored to to their former condition. If, however, this does not take place other results will follow, which it is the object of this paper to consider, and if we can reach an understanding of what may be expected from the standpoint of pathology and from the most reliable practical observations, we may be able to answer certain questions and come to conclusions which will be just and proper.

Leaving out of consideration for the present moment

the results of infection, we will consider the effects of the osteoplastic process when resolution does not take place. I think it proper to stop long enough at this point to say that chronic irritation or inflammation of bone can not continue for an indefinite period of time without certain organic changes taking place. Assuming an injury to be the cause of an inflammation or an irritation of a more or less persistent character, we have as a result a proliferation of cells.

The density of bone tissue is such as to interfere with this multiplication of cells without the occurrence of a coincident absorption of bone substance, hence the bone changes in condition. The vascular structure of bone periosteum and medulla are involved, becoming more vascular and an exudation takes place underneath the periosteum into the medulla and into the enlarged Haversian canals, or in spongy bone into the trabecular structure. As the embryonic cells increase in number the osseous lamella becomes softened and absorbed and the lacunæ become larger, and these with the enlarged Haversian canals become filled with granulation tissue together with multinuclear cells, osteoclasts, which are believed to aid in the absorption of bone.

This form of inflammation of bone, known as rarefying ostitis, is attended with the formation of new bone beneath the periosteum and in the medulla, hence two processes are observed: 1, new embryonic cells and enlargement of lacunar spaces and Haversian canals; 2, the conversion of the new elements into bone.

Therefore the two processes of rarefying and formative ostitis occurring together give rise to conditions

which will vary according to the predominance of the one or the other. If the irritation continues, resolution, of course, does not take place and disease becomes progressive, involving well determined pathologic changes, be they of the character of rarefying ostitis or osteo-sclerosis. If the disease is chronic or slow in development the rarefying process continues until an abnormal degree of sponginess is reached, whereby the bone becomes larger, lighter and lessened in its power of resistance and fracture easily occurs. Section of a bone which has undergone this change will show the numerous spaces, the enlarged Haversian canals and medulla or the more fragile condition of the trabecula. The extent of these abnormal appearances will be determined by the degree of inflammation present and the advancement it has made.

If, instead of the continuance of the rarefying process, the bone granulation tissue becomes organized and new bone is formed, the spaces become slowly filled, the medulla is encroached upon and the bone becomes changed in character; it becomes harder and denser. The continuance of the bone formation process indefinitely must result in an interference with the vascular supply by compression of the blood vessels and an ultimate interference with the nutrition of the bone, leading finally to necrosis of greater or lesser areas. If, however, the disease becomes arrested at a point short of a serious interference with nutrition, the condition of osteo-sclerosis may remain permanent. The lesson, then, to be derived from a consideration of the pathologic changes in chronic inflammation in bone, teaches that this condition can not continue indefinitely without giving rise to well marked internal and also

external changes, which may be readily recognized if the bone is situated superficially so as to place it within easy reach. No doubt slight degrees of pathologic changes may take place without objective signs which can be discovered by ordinary surface examination.

It appears from a considerable personal observation among railway and mill employes that the organic changes in bone resulting from chronic inflammation rarely terminates in complete resolution, a degree of permanent thickening remains, which, however, gives rise to no troublesome symptoms or disability, unless the thickening is in the immediate neighborhood of a joint. There may be no constant relation between the severity of the subjective symptoms, the extent of pathologic changes and the objective signs, but it is fair to presume that if symptoms of disease persist without abatement, more or less active changes are really taking place with the results already indicated

The foregoing relates to cases which escape the influence of microbic action, either septic or tubercular. In predicting the future results of bone inflammation we have always in mind the possibility of infection. In general terms it may be said that the more abundant the granulation tissue, the more active the suppurative process in the event of pus infection, a condition most often met with in inflammation of spongy bone, or in the trabecular structure of long bones near the articular extremities. A traumatic osteomyelitis with pus infection, occurring early or late, means a pathologic condition, manifested by evidences of a positive character, showing very soon the serious nature of the lesion; the more or less rapid

approach of pus to the surface, redness and inflammation of the soft parts and final discharge, and the formation of sinuses communicating with carious or necrotic bone. In the case of rarefying ostitis of denser bone, the granulation tissue filling the enlarged spaces may become infected and the lesser formation of pus, and the more localized process may give rise to a small abscess, chronic in character and occasion less marked symptoms, but in the search for the cause of the symptoms the objective evidence will be unmistakable.

Tubercular infection of the actively granulating tissue will be marked very soon by an accession in the symptoms and a more decided progress of the disease, the early formation of sinuses consequent on the development of tuberculous pus, and if double infection from the invasion of the true pus microbe happens, the added constitutional symptoms of sepsis will follow.

There can be no doubt according to the best authorities that an ostitis of traumatic origin, even if resolution has taken place, at least to the extent of subsidence of all active inflammatory processes, may become the focus of a tubercular development, by serving as a point of least resistance. But can we say that this local predisposition to tubercular infection is permanent, *i. e.*, that after all inflammation has subsided and the structural changes have been followed by a restoration in the nutritive balance, can we say that the thickened bone, or the bone that has been subject to an inflammation, is still exposed to the special danger of a tubercular disease. The best evidence is to the effect that when the nutrition of the bone has

been restored the *locus minoris resistentiæ* ceases to exist. The time for infection is when the nutrition is impaired by the products of inflammation, or when the products are in that special condition which invites the cultivation of the bacillus tuberculosis. It may be difficult to determine when the bone has become restored to that condition of normal resistance, but to my mind the appearance of a tuberculous process long after all evidence, save the thickening, of the inflammation has disappeared, is not sufficient evidence of the causative relation of the inflammation itself.

It is generally admitted that an injury to a bone, particularly to the cancellous structure in which trabeculæ are broken or in which a minute hemorrhage occurs may be the foundation of a tuberculous inflammation having its exact seat either in the new cells formed incident to repair, or in the hemorrhagic focus.

In the examination of a case of bone inflammation, even when resolution is apparently going on favorably, we can not avoid the apprehension that a tuberculous process may develop at any time, and in the light of this fact our opinion must be guarded, for the otherwise reasonable expectation of a recovery may not be realized. If it is true, as it is generally accepted, that an injured or chronically inflamed bone is subject to tubercular infection, for how long a time and under what circumstances may the above conditions serve as etiologic factors in the production of the disease? Much loose generalizing has been indulged in on this point and efforts have been made to show that a slight injury to a bone may give rise to a

locus *minoris resistentiæ* which will especially predispose to the disease for an indefinite time. That is, if a bone becomes injured and all symptoms of such injury subside, yet after months, or even years, tuberculous process develops. Therefore, it is said that the injury is the remote cause. It may also be assumed in a given case of injury that even if apparent recovery takes place the claimant is exposed for an indefinite period to the rise of a dangerous disease as the logical sequence of the injury.

I am not advised that any modern writer of eminence holds to this view, but it is a fact that opinions of this character are entertained by members of the profession. Senn regards bone tuberculosis as the result of trauma under any circumstances as rare, and Cheyne, while believing in the etiologic influence of injuries in producing bone tuberculosis, cites only a few cases in which there was satisfactory evidence to his mind of the causal relation, and in all these cases the tuberculosis followed immediately without any apparent recovery from the injury itself, and the same is true of all other cases recently recorded. Referring to a previous statement in this paper, I contend that the circumstances under which infection must occur, if at all, is when the local resistance in the bone is impaired by the injury; or in the presence of a minute hemorrhage; or in the presence of granulation tissue as the result of a mild inflammation or repair; and the limits of infection must not extend beyond the restoration of the injured bone to its normal condition and that the evidence of such restoration must be the disappearance of objective symptoms in bones subject to easy physical examination.

The origin of a true bone tumor from a metaplastic process is no longer entertained. The formation of an exostosis or a localized or diffused hypertrophy from the reparative process in a bone following an injury may occur, but the fact is so plainly indicated by the physical condition of the bone that it can not fail of recognition and the continuity of symptoms subjective and objective with the development of the bone enlargement will indicate the causative relation, however slow the process may be. In the process itself we recognize the histogenetic changes already considered, viz.: Hyperemia, exudation and proliferation of cells from the deeper layer of periosteum and the conversion of the osteoplastic elements into bone.

The development of sarcoma from bone trauma is altogether possible, especially in persons predisposed through heredity. This is occasionally seen to occur in the immature callus after fracture.

In irritation following trauma newly formed embryonic cells may form the matrix for a sarcomatous development through failure to undergo transformation into tissue of a higher or more resistant physiologic type. That hereditary predisposition is not absolutely necessary in the development of a sarcoma matrix, although it must be assumed in the present state of knowledge of the histogenesis of tumors that a preëxisting matrix of embryonic tissue was present to be lighted into activity under favorable conditions, was shown in a case which came under my care some eight years ago. A man received an injury to the middle of the right humerus, not sufficient to produce a fracture; this was followed by a moderate irritation in the bone accompanied by sufficient pain or uneasi-

ness to attract his attention when not otherwise engaged; in a few months he observed that the bone was increasing in size. The enlargement gradually increased during a period of two or three years, until it became difficult to pull over it a coat sleeve of ordinary size; finally the bone was fractured by ordinary muscular effort. The bone appeared to unite but the condition became so troublesome that he consulted me. The malignant nature of the disease was so apparent that I had no hesitation in declaring it to be a sarcoma of the bone, and advised amputation at the shoulder joint. The proposition was promptly accepted and the arm removed. A microscopic study showed the disease to be a sarcoma of the myeloid type; the growth beginning in the medulla and finally leading to the absorption of bone and extending to the contiguous soft parts. There has never been any return of the disease. The sequence of events satisfied me that trauma was an important factor in the etiology of the disease.

The practical propositions involved in this paper are based on inflammation or irritation in bone following injury and the sequel resulting therefrom.

1. Resolution, including a complete restoration of the bone to its normal condition, occurs in the vast majority of cases.

2. Resulting in rarefying ostitis. Condensing ostitis, or a combined rarefying and condensing ostitis, which may remain as a more or less permanent condition; if slight in degree giving rise to no well marked subjective or objective signs after the process becomes arrested.

3. If the process continues for a period beyond a

few months, well marked and unmistakable changes in the physical condition and appearance of the bone will become manifest.

4. A persistent acute or chronic osteomyelitis will also give rise to unmistakable physical changes in the bone.

5. A persistent chronic osteo-periostitis will give rise to thickening of both periosteum and bone of a character that will be readily recognized if the bone is so situated as to admit of easy surface examination.

6. If the products of inflammation in cases of rarefying ostitis or in osteomyelitis become infected with pus-forming microbes, the suppurative process will become plainly evident, except in cases in which the process is very limited, giving rise to a small abscess in the bone which may be indicated only by subjective symptoms.

7. The injury and irritation following may establish a locus minoris resistentiæ which may become the seat of tubercular infection with certain definite results. The length of time after a trauma, during which this influence may exist, can not be definitely determined, but it may be assumed in the light of critical practical experience and pathologic research that the special predisposition will cease to exist as soon as the effused blood is absorbed, and the protoplasmic elements—the products of irritation or inflammation—have been resolved into new bone or have undergone degeneration and absorption, *i. e.*, as soon as the normal nutrition balance is restored. I do not believe there is any scientific evidence or any practical facts that will bear criticism, which will support the assumption that the locus minoris resistentiæ may

continue for months or years after all signs of the injury and its immediate results have disappeared.

8. There is no evidence to show that a carcinoma or sarcoma may develop as the result of an injury after the immature bone elements have become transformed into tissue of a normal resisting physiologic type.

DISCUSSION.

Dr. REED, Columbus—The subject of "Remote Effects of Bone Trauma" is of interest to every surgeon, and especially to the railroad surgeon; the repairing of bone, the possibility of disease and the changes that are wrought, are all points which may interest the surgeon and interest the company—especially if the patient has occasion to call on the company for damages. The subject has been very ably handled by the Doctor; he has reviewed in brief and concise form cases relative to the repairing of bone, and the changes which take place in the anatomy, in an admirable way; at the same time there are some points which the Doctor did not touch upon, and which might be of interest to us in this connection. I have no doubt you have all had occasion to observe in your practice cases in which you had taken the best care, and in which you had put on the ordinary splint, kept the bone in proper position and to all appearances in apposition, kept him quiet the ordinary amount of time, the patient had got well; and yet after all this the patient after he was given his liberty would go out and come back to you probably in one or two years afterward with a deformed limb. Now the question comes up, Is that the fault of the surgeon or is the company in any way liable? I have in mind two cases of this kind in which the patients had a fracture of the femur, an ordinary fracture in one case and an oblique in the other; in each the patient was cared for by a competent surgeon, and was dismissed with little or no deformity, or very little shortening, and yet in each case after the patient had gone out about his business his limb became deformed. Now we have there a case of imperfect repair. We have no doubt had in the first place a perfect union, the intervening space filled, new bone tissue formed, that is, the bone cells had bridged across the chasm, but they were not properly

supplied with lime salts so as to harden them, and the result is that instead of that new bone becoming solid it was still elastic, of a cartilaginous character and we, in one case, had the bone not becoming actually displaced but giving away and causing a bow leg. In the other case the union was solid and the weight of the man on the limb gradually forced the bones past each other, not because they were not united, but because there was not sufficient bone salt to make the new bone hard. Those are points I do not think the railway company or any other company are responsible for. I think we ought to discriminate between cases in which deformity followed a union and the case where the surgeon did not properly adjust the bones from the case where the man does not have sufficient vitality to repair the bone properly, or to furnish the lime salt after the new bone was formed. Again, in reference to sarcoma, the Doctor speaks of what I think it is well to remember, that in the case of sarcoma we can not have a sarcoma following traumatism—and I think Dr. Senn has gone into that in his last work very thoroughly—unless there is is a prenatal or post-natal embryonic cell condition; if there is a prenatal or post natal disposition then a traumatic trouble may cause sarcoma, but this must exist prior to the injury and is liable to be the result of previous condition because we know sarcoma does occur without there being a trumatism at all.

In reference to tuberculosis, I recall a case that came to my notice in the hospital a year and a half ago, in which there was a marked case of tuberculosis; a gentleman had pulmonary tuberculosis, which was confirmed not only by expert diagnostitians, but by microscopic examination of expectoration, and in this case the person was emaciated and to all appearances he would die from tuberculosis before he had time to repair bone. It was a railroad accident and he was caught between the cars when the accident occurred, and there were seven distinct fractures distributed between ankles and knees. I observed in this case one fracture repaired at a time—one fracture and then on the same limb another fracture and so on; it went the round, finishing one limb before repairing the other; it was a beautiful case, and notwithstanding he was suffering from tuberculosis, coughing and expectorating profusely, the repair processes went right along just as promptly, so far as any one

fracture was concerned, as if tuberculosis did not exist at all. Now the point is this: If tuberculosis is liable to come as the result of injury why would it not occur where the man was suffering from tuberculosis and the whole system run down from disease and in an ill condition to take on reparative processes at all, but we do not have it occurring in any other part of the system excepting the lung. I simply bring these cases up to emphasize what the Doctor has said in his paper, that I do not believe an injury, a traumatism, is conducive to the development of tuberculosis or sarcoma in and of itself, that it requires a condition that is entirely separate from the traumatism to induce it.

Dr. E. M. Dooley, Buffalo—Dr. Reed's remarks in reference to remote effects of bone trauma in case of fractures recall to my mind an interesting case that occurred in Buffalo about three years ago in which the case was a fracture of the tibia about the middle, and a classmate of mine attended him. He had a perfect result and a rigid union and the patient was able to use his limb. But a year afterward at the seat of fracture the callus softened and he had in reality a case of nonunion. The case was interesting because the surgeon was sued for malpractice. Now it was a case of the fault of the patient and not the surgeon, yet, although the surgeon won his suit, it put him to a great deal of expense, both in time and money. And I think these remarks in reference to the possibility of fracture, after it has firmly united to all appearances, softening a year or year and a half later, worthy of emphasis.

Dr. C. K. Cole, Helena—*Apropos* of what has just been said, I wish to refer to a case which occurred about two years ago in the practice of one of my neighbors, and which illustrates one of the phases of the subject touched upon in this paper. A man while riding on horseback was rubbed against a tree and the humerus was broken near the head, which was dislocated. The accident occurred in a remote region and a doctor was not consulted until, I think, four days subsequent, when the man received proper attention. The head of the bone was reduced, the fracture was restored. The patient then and for some weeks following complained of pain, increasing constantly. He consulted a prominent surgeon in San Francisco, who, after making a cursory examination said some things to the patient

which reflected upon the doctor who had charge of the case, and these reflections suggested to the patient a suit for malpractice. But before bringing the suit, Dr. Senn of this city was consulted, and Dr. Senn discovered—I think this was some four months after the accident—an osteo sarcoma. Amputation was resorted to, injections were practiced, and the patient remained in St. Joseph's Hospital for some weeks; he returned home and again came to Chicago and was again treated, in the meantime having instituted legal proceedings against the doctor; and he died here in Chicago from a bona fide sarcomatous growth. The reason for calling attention to this case is that it is pertinent to one phase of the subject discussed in the paper and that is a phase of the subject that is not well understood. The fact that a traumatism may precipitate this growth, as Dr. Reed has well said, so far as our knowledge goes there is a preexisting condition, but an injury of this kind does precipitate a growth of this character. The medico-legal aspect is interesting to us as railway surgeons, because unless this is well understood we, and the companies we represent, are liable to be sued for malpractice in cases in which we are not at fault.

THE PRESIDENT—I remember a case where a blow was received on the clavicle and on the skull, and sarcoma developed in both places, at the two contusions.

Dr. GALBRAITH, Omaha—I don't believe we will have a more important paper before this Association than the one just read. While we have so far confined ourselves entirely to pathology of bone trauma, bone inflammation and the products of bone inflammation, I think it would be well for us to give the treatment of these conditions, these lesions, some consideration, more especially as to that part of the bone which enters into the formation of the joints, inasmuch as the treatment in my belief, varies as regards the location of the bone, more especially does that apply to traumatic osteomyelitis. At various times I noted that the Doctor spoke of resolution following, as I understood, simple osteomyelitis. This may occur, but as regards the syphilitic, I do not think it possible; I believe osteomyelitis attacks this portion of the bone. More especially is this subject one, or should be one, of the most serious considerations that is presented to us of a surgical character, and

my results in almost every case I can recall to mind now have been a necessitated amputation.

Dr. WARD, Conneaut—I happened to be unfortunate enough to witness a case in which a man 50 years of age had a very large osteo-sarcoma develop after the fracture of a clavicle. From its magnitude, before attention was called to it, any operative procedure was interdicted, but, in connection with it there developed a very friable condition of the osseous structure generally, and from the simple act of turning in bed, or something of that kind, fractures of one or more of the limbs occurred, and death finally ended the scene. This man was supposed to be healthy and in good condition until he met with the accident leading to the fracture of the clavicle, but from that time on there was a general decline, with the development of the condition specified filling all the space. It was a very large growth and a degeneration of the bone structure generally. There must have been a preëxisting constitutional condition, but undoubtedly, in that case the fracture was the exciting cause or the developing cause of the trouble that immediately followed.

Dr. REED—Permit me just to make one statement in rebuttal, as they would say in court, to the remark made by our distinguished President; he spoke of sarcoma following contusion on the head and on the clavicle. I simply want to say, not less than eight weeks ago, I made an an exploratory incision into the abdomen for the purpose of diagnosis, and there I found a sarcoma of the liver and the left kidney, the lower portion of the right lobe of the liver and the right kidney, and both distinct, as far as any anatomic connection was concerned.

Dr. EAGLESON, Seattle—A young man about 28 years of age, inmate of a penitentiary, while working in a brickyard received a blow on the right side of the skull from a piece of brick thrown by one of the other inmates, and a few months later a tumor developed at the point of injury, which was at first attempted to be removed by the surgeon of the penitentiary; he had to stop the operation on account of excessive hemorrhage; I believe that he attempted to do it under cocain without an anesthetic; a few months later he gave an anesthetic and removed the clot, scraping off the bits of bone; it healed nicely, but a few months later it developed again, and when it

came back, a year ago last June, I observed there was a tumor on that side of the skull as large as a goose egg; I pronounced it a sarcoma. I happened to have at that time some of Dr. Colles' culture of the erysipelas and commenced the use of that by injecting it in the tumor and pushed it to the extent that I almost killed the patient, but it had no result on the growth. It went on and a few months later another tumor developed on the opposite side of the skull about the juncture of the parietal with the frontal bone, and in a short time he developed paralysis on the left side from pressure on the right side, and died. A postmortem was had; the tumor went down through the skull and pressed on the brain as large as a goose egg and there was a deposit of two or three pounds of the sarcomatous growth in the left cavity. A sarcoma resulted from contusion of the bone in this instance.

Dr. Baldwin, Salt Lake City—A man running from a policeman jumped on a shed and broke his thigh. I happened to be one of two to dress the wound. After the first, there was union there but not a bony union. Afterward he fell into the hands of Dr. Cole and that portion was excised and the bone wired, but never got a union; the result was that they finally amputated it. I have in mind another case that possibly shows the result of very remote traumatism: A young boy about 13 years old was playing with a dynamite cap which exploded and struck him on the head and it was thought only the outer table of the skull was fractured. But it went on for something like four years, when I first saw him and he began to suffer with severe pain, I do not know how long, but two or three years after the injury; and it kept up so long that it was said that something was necessary to be done. At the same time, I think about the time the pain began, he began to have indigestion—he could not eat anything or keep anything on his stomach. Dr. Cole and myself trephined and removed a portion of the bone and afterward he was relieved of the pain and materially relieved of the indigestion or the stomach trouble. Now what connection that could have with the stomach I do not know, but certain it was he was relieved considerably.

Dr. Fairchild—The object of this paper was to call the attention more particularly to sequelæ which might appear as the remote effect after apparent repair had taken place. It

sometimes happens we have a patient alleging pain and difficulty in a bone like the tibia, for instance, which is exposed to easy examination and it is alleged this is due to inflammation in that bone. On examination we find nothing whatever, no thickening of any kind in any direction. Now, the question would be whether or not we could have an inflammation persisting in a bone for a long period of time, say one or two years, without any marked signs being manifest. That was one of the propositions in the paper, whether we could have a bone inflammation continue without giving rise to physical signs. I have one or two cases of that kind, a patient that hobbled around on crutches and having litigations over it, and yet a physical examination showed no sign whatever of a physical character. Then further along after the injury we might expect tuberculous disease to develop. Now in case of fracture I believe it is true that tuberculosis does not generally occur, because reaction is so active that tuberculosis is not ready to develop, that it develops in slighter injuries. Now, in slighter injuries can we say a tubercular process is liable to develop in that bone. Suppose for instance a patient received injury and it apparently healed, no sepsis discovered; yet eighteen months or an almost two years, say, lacking a day, the patient has a tubercular process develop. Now a suit is commenced, instituted on the ground of tuberculosis as the result of the injury, and yet there was no sepsis for many months. These were points on which I was anxious to get some information. Again, in case of injury to a bone which has healed, repair has taken place, and yet a year and a half after that a sarcoma develops at the seat of injury. Sometimes we are able to determine that all the nutritive balances have been established, the cells have reached maturity, perfect physiologic poise has been reached, and yet a sarcoma develops. Can we say it was the injury which caused that sarcoma, or that it resulted from the injury received months before? Those were the points I desired to bring up, and in looking up the authorities I have had difficulty to find any authority specific enough on this subject as to enable one to believe or to form an opinion as to a consensus of medical opinion. We hear in litigation, what changes will occur in bone tuberculosis, and I have attempted to say that when the nutritive balance was restored in the

bone then the danger from tuberculosis was ended, and the q
tion would be to determine when the nutritive balance
restored, whether the repair process has occurred and
restored to maturity. We do not believe the cell that
reached a state of maturity will become degenerate, so th
bone when the bone has become restored to a normal co
tion tuberculosis does not occur as the result of injury.
pretend to say that in injury to the bone if the cells bec
restored to physical maturity, if sarcoma develops, it is not
result of the injury. It was not intended to discuss the q
tion of reabsorption of the callus in case of fracture, altho
as the discussion has gone in that direction I will menti
case, a compound fracture of the bones of the forearm;
part healed without union; the bones were resected and w
and union began. Then it was noticed after a while tha
additional joint existed, that is the callus had become absor
A friend of mine in Washington was operated on in the s
way, and I had a letter from the doctor in which he state
had excellent results. I saw the case six months later and
additional joint was there. But this branch of the subj
did not take up, but simply the matter of the future possi
ties in the examination of an individual case; and in exa
ing a case in which there is a claim made, can we say this
dition has any bearing upon the injury which the pe
alleges to have received?

CHAPTER V.—INJURIES OF THE JOINT.

THE CAUSE AND MECHANICAL TREATMENT OF SUBLUXATION OF THE KNEE-JOINT.

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In order that the treatment of subluxation of the knee-joint may be properly carried out its cause must be thoroughly understood.

Subluxation of this joint is an under-dislocation of the head of the tibia back of, or posterior to, the condyles of the femur. Such a deformity does not exist as a result of chronic disease when the femur is kept parallel with the tibia, during tubercular, synovial, traumatic, gonorrheal and other inflammatory diseases in and about the knee-joint. It can only result from direct violence and from faulty position during the course of treatment.

The series of experiments has been carried out to determine the relative power of the flexor and extensor muscles of the leg, as well as to determine at what angle, in flexion, the flexor muscles equal the extensors in power. We must remember that extension of the leg is limited to a parallelism with the thigh, and that flexion is only limited by the resistance of the calf with the thigh muscles, or through an arc of 75

degrees. In extension the flexors and extensors are antagonists, and oppose each other with equal advantage, so far as the position of the bones themselves are concerned, because they both have direct action. The advantage, however, is in favor of the extensors, because they are always more powerful. When the leg is flexed the extensors lose their power of direct action and act over a pulley. This pulley is formed by the action of the quadriceps extensor femoris, patella and ligamentum patellæ over the condyles of the femur. As the leg is flexed the extensors lose power and the flexors gain. In order to determine the power of these sets of muscles and to more particularly determine at what angle of flexion the flexors equal the extensors, experiments have been carried out.

Without giving in detail the various experiments which were made upon different individuals, it was found that the extensor muscles upon an average had a resistance of thirty-two pounds, and the flexors twenty-four pounds and that at an angle of about 35 degrees the resistance of the extensors was reduced to twenty-four pounds. This shows that the extensors and flexors have equal power when the leg is flexed to an angle of 35 degrees. A slight variation from the above is found in different individuals.

The experiments were carried out by the use of a goniometer, a pair of spring scales, and four hooks on the jam of a door, one on either side opposite the knee and the other two below these near the floor. To test the extensors, a tape is secured to the hook in front of the knee and thrown around the knee above the joint. The scale is hooked to the hook back of the

foot, and another tape is thrown over the ankle and the free ends passed through the ring of the scale. With the leg in extreme extension the tapes are drawn through the ring of the scales. The scales will first register the extreme power of the extensors, but as it is drawn back to about 10 degrees it requires less force to make flexion, hence, a reduction on the scale dial.

To test the flexors, the scales are placed in front of the foot and the knee secured from the hook immediately back of it.

It is quite customary to treat the diseased conditions of the knee-joint in flexion, the degree of flexion being determined by the attending surgeon. Some reasons given for this are that it places the leg in a better position for use during after years, or it is more comfortable to the patient, etc. All of the reasons given are fallacious and founded upon anything but sound reasoning.

In the case of traumatic and other forms of synovitis it is probably true that a greater area of synovial surface is included between the heads of the bone and semilunar cartilage. Such a reduction in actual surface pressed upon could not diminish the pressure, but would place the leg in a less secure position and thus increase muscular spasm and as a result increase intra-articular pressure.

It must be remembered that all muscles which pass over, or the tendons of which pass over or control the action of a joint in inflammation, are in a state of spasmodic contraction. This increased action on the part of the muscles is an effort on the part of nature to protect the sensitive joint. The deformity which

follows is in the direction of the most powerful muscles, or sets of muscles.

In hip-joint disease it is flexion, adduction, or abduction. In tarsal disease it is valgus, varus, flexion, extension, etc. In knee-joint disease it may remain normal, as it generally does in diseases of the shoulder or wrist, so long as the leg is kept in a position

FIGURE 1.

FIGURE 2.

favoring this. Just as soon, however, as the flexors have a greater power than the extensors we have an increase of flexion.

As a result of my experiments an approximate estimate of the muscular power showed that the flexion at an angle of 45 to 50 degrees, the flexors had absolute

control of the leg. This will admit of two things, an increase of flexion and a tendency of the head of the tibia to glide further back under the condyles. This is not only correct theoretically, but it is borne out clinically and has no doubt been observed by many of my hearers.

I have thus dwelt at length on the cause of the condition under consideration in order that the treatment might be preventive rather than that we be called upon to correct the deformity after its existence.

The treatment of subluxations may be summed up briefly as follows:

It must first be determined whether true or false ankylosis exists, whether the dislocation is partial or complete. In true ankylosis a complete section of the bone must be made either by the use of chisels or saw, and if the relationship of the bones can not be restored without it, a wedge-shaped section should be made, the bones brought together or otherwise secured.

In cases of ligamentous or false ankylosis with a partial subluxation, *brisement forcé* with tenotomies of the hamstring tendons is generally sufficient. The most difficult cases to manage are those where the adhesions are more or less firm and a complete luxation of the bones exists.

Tenotomies of the tendons will free the lower portion of the head of the tibia, but great force does not as a rule restore the joint surfaces to a normal relationship. It is quite possible, after tenotomy, to bring the leg parallel with the thigh, but it will be found that the leg is upon a lower plane than the thigh. This is due to the fact that the head of the tibia does not slip down and forward upon the con-

dyles, but instead the relationship of these bones are not disturbed. The condition which exists is shown in the drawing (Fig. 1), representing the condition before correction. Figure 2 represents the condition as the bones are brought parallel, which, as may be observed, increases the pressure of the anterior surface of the tibia against the condyle of the femur, and thus prevents the head of the tibia from gliding forward over the condyles of the femur.

Immediate reduction of subluxation of the knee-joint is prevented: 1. By the adherent patella and synovial membrane to the condyles. 2. By the impinging of the anterior portion of the head of the tibia against the condyles. In cases where the hamstrings are not cut this burrowing in of the bones upon each other is much greater, and an immediate reduction is less likely to be effected. Gradual and continuous leverage offer the best means for correcting the deformity mechanically. In this degree of deformity a rapid cure can not be promised, except by a radical operation.

A complete correction mechanically must not be attempted at the time of the practice of *brisement forcé*, but instead the leg should be carried forward to an angle that would permit a gradual correction of the subluxation. If plaster of Paris is used as a support, it should be reapplied every ten to fourteen days.

DISCUSSION.

Dr. MAYO—Dr. Gillette of St. Paul, in a number of cases, has broken up the adhesions by means of great force, using some form of mechanicul apparatus in one sitting and without tenotomy. I have myself been afraid to apply this extreme degree of force, and, if the deformity is sufficiently great, much prefer to make an osteotomy of the femur after the method of

Macewen; this, it appears to me, gives the best results with the least loss of time and danger. The mechanical apparatus of the doctor I believe would succeed better in the hands of the inventor than with the rest of us. In my experience I have seldom been able to succeed with another man's splint as well as does the inventor himself, and as a rule do better with the plaster of Paris cast.

Dr. HAWES—I wish to take exception to one statement in the paper; no mention is made of complete reduction of the subluxation at one sitting. I think the best result I ever had was where it was necessary for me to use force; I actually tore the skin in the popliteal parts. The splint I have been accustomed to use has two bars on the outside and one inside, extending from the inside of the thigh to the heel and outside to the heel and carrying the bandage around it all, behind the tibia. It seems to me I ought to get better results than I would with this splint.

Dr. MILTON JAY—There should be a recognized difference in subluxation of the knee-joint, whether it is the result of disease and hence chronic, or whether traumatic. In traumatic subluxation the reduction should be accomplished at once. We will often succeed better in the reduction by increasing the deformity, by bringing the leg to a right angle with the thigh, then flexing the thigh upon the abdomen, forcing the leg forward in this position until the articulating surfaces of the head of the tibia and condyles of the femur come in contact, then straighten the leg to normal position. But when the displacement is of long standing, gradual and continuous extension will be required until the reduction is accomplished. This may be and often is difficult to accomplish. Even if complete and satisfactory reduction can not be accomplished at the first attempt on account of the adhesions in the joint and the contraction of the hamstring muscles, it will be well to retain all the advantage we have gained by fixing the limb in a plaster cast and wait a few days, then, under the influence of an anesthetic, complete the reduction and fix the limb in a plaster cast, and not be in too much haste about instituting passive motion; weeks will generally be required to produce permanent ankylosis of the joint.

Dr. MCCURDY—I have avoided any positive recommenda-

tion in the paper, in order that my idea or opinion might not be forced upon you. The subject is considered in a general way, more particularly to call your attention to the power given to certain sets of muscles, so you could enter into a consideration of the histology of this deformity and thus prevent the deformity, at least treat the cases that came into your hands perfectly straight: there is every reason why you should do this rather than to treat in a slightly flexed position; it is a very common thing for doctors to say the leg ought to be flexed a little. I might call your attention for a moment to the question of the pulley action of the muscles. You see if the leg is parallel there is a direct action of the extensor muscle; the flexor muscles represent 75 per cent. of that power when the leg is in a complete or almost flexed state, because the power of the complete flexion is not quite as much—about 5, 8, or 10 degrees from the complete flexor, but when you bring it to 35 degrees then the power of the flexor equals the extensor, because the extensors are acting over a pulley, and direct action has greater power than the action as represented by that, and that will be easily seen if carried out on paper. It was the intention to point out the connection between disease and chronic deformity. Of course we know what to do in case of accident to this joint, to restore normal relation of the bone, and it is well to know what to do to the hamstring, or the tendon, and if the patella is found adherent to put a gouge in and lift the patella from the adhesion, or if the condyle of the femur on the synovial membrane, down anteriorly to the head of the tibia.

ON THE RELATION OF TUBERCULOSIS OF THE KNEE TO INJURIES OF SAID JOINT.

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The observation that injury of a bone or joint is frequently followed, after a variable interval, by chronic inflammation at the seat of injury, such chronic inflammation assuming the nature of a white swelling, or of destructive suppuration, or of caries, has long been familiar to the medical profession.

When, thanks to the labors of Volkmann, Koenig, Koch and others, the true nature of these chronic processes was incontrovertibly shown to be tubercular, the question of their relation to the trauma to which they were attributed, became one of great interest to the surgeon and pathologist as well as from a medico-legal point of view.

Tuberculosis being a specific bacterial disease, always depending for its causation on the presence of a well defined and constant bacillus, what part, if any, does injury of a bone or joint play in the subsequent development of tuberculosis at the site of such injury?

Since in the discussion of this subject, what applies to one joint is generally true of other joints and bones, I shall for the sake of convenience use the terms *bone* and *joint*, instead of speaking specifically of the knee-

joint, though the latter, on account of its large size, extensive area of cartilage and synovial membrane, its exposure to frequent injury, the frequency of the occurrence of tubercular processes in it, and the ease with which its interior can be exposed and examined, is more than any other joint adapted for the study of the questions under discussion.

The accession of a tubercular arthritis or osteitis following closely, or after a few weeks, upon an injury of these structures, occurs with such sufficient frequency, that few clinicians at the present time deny the connection of the trauma, as one of the factors at least, with the production or localization of the local tuberculosis.

The importance of the trauma has no doubt been overestimated, especially before the etiology and pathology of tuberculosis were thoroughly understood. The tendency to attribute to two successive occurrences the relationship of cause and effect, has here, as in many other instances, greatly retarded a correct interpretation of the phenomena under consideration

That injury is not an *essential* or necessary factor in the causation of bone and joint tuberculosis, is shown by numerous cases in which the most careful investigation fails to disclose any history of preceding trauma. It follows that, even where the latter has occurred, the causative relation between it and the tuberculosis following can not be absolutely proven and may always remain a matter of some doubt.

Admitting, however, that such causative relation exists, how can we account for it, and what significance can reasonably be attributed to it?

Looking at the matter in the light of modern path-

ology, we can not admit that a trauma or any of its consequences can produce or furnish the essential factor of the disease, the tubercle bacillus. The trauma can at most serve as a means of introducing the bacillus into the system, or determining its point of attack if already there present. In other words, in order that the trauma may enter into the causation of the local disease the bacillus must either be present in the system at the time the injury is sustained, or be introduced at the time of the injury, or subsequently, before the effects of the trauma have disappeared. If previously present, the trauma may act as an *exciting cause* for the *local* tuberculosis by creating an area of lessened resistance for the attack and localization of the bacillus. If on the other hand the bacillus should gain access to the system *after* the occurrence of the injury and before the abnormal local and general conditions created by the latter have subsided, the trauma may assume the rôle of *predisposing cause*, by furnishing a favorable soil for the bacillus and enabling it to gain a foothold. I say local and general conditions, because tuberculosis being a communicable disease, there can be no doubt but that its invasion is favored by lessened vital resistance, both local and general, and by enforced confinement and other unfavorable conditions brought about by an injury.

Both clinical experience and pathologic investigation go to prove that the majority of cases in which tuberculosis of a bone or joint develops at the site of an injury, belong to a class in which the disease had been established in other parts of the body before the injury was sustained, in which the latter must therefore be regarded as merely an exciting or local-

izing factor. The bone or joint tuberculosis in these cases is metastatic or secondary, the infecting material being derived from some older tubercular focus located either in the lymphatic glands, lungs, alimentary canal, urinary or sexual tract, or the skin. Such old foci were found by Orth in 79 per cent. of fatal cases from Koenig's clinic. Making some allowance for cases in which they may have been overlooked or have healed by cicatrization, the percentage may be safely assumed to be still higher. While the mere presence of these foci does not prove them to have been the source of infection for the bone and joint disease, their presence is at least very significant. Unfortunately such old tubercular centers, if small, and especially if latent, will often escape detection during life by even the most careful examination.

Direct tubercular infection of bone or joint through an open wound is so exceedingly rare, that only a single case, and this not without some features which render it doubtful, reported by Mittendorpff, has found its way into literature.

This leaves a small contingent of cases in which to all appearances at least, the local tuberculosis must be regarded as primary, in which, in other words, the tubercle bacillus having gained access to the system by way of the air passages or alimentary canal, becomes located and develops in the injured bone or joint without having first caused a lesion in any other part of the system. Analogous processes no doubt occur in cases of osteomyelitis, periostitis and other infectious diseases following injuries not accompanied by wounds of the skin.

Whatever may be the sequence of events leading to

the development of bone or joint tuberculosis, accumulated clinical experience has established the fact, that injury is very rarely followed by the disease except in individuals who either have previously carried the disease in other parts of the body, whose family history shows evidence of a tubercular taint, or who are burdened with that peculiar predisposition or tendency to tuberculosis known as scrofula. While the correctness of this statement may not seem to be borne out but rather disproven by many cases when they first come to the surgeon's notice, its truth will be confirmed if the patient and his family can be kept under observation for a few years. About six years ago I treated a boy 8 years old, for tuberculosis of the tarsal bones, attributed to a slight injury. At that time there was not the slightest evidence of hereditary taint, but since then the boy's father and father's brother have died of pulmonary tuberculosis, and a daughter of the father's sister is now in an advanced stage of the disease.

Clinical observation has established the further fact, that the kind of injuries most frequently followed by tuberculosis, are those of a milder type, such as moderate blows, sprains or bruises; while fractures, dislocations and severe crushing injuries are very rarely so followed. The conditions produced by a mild trauma seem to furnish a favorable soil for the tubercle bacillus, while the more intense reaction following severe injuries seem to antagonize it. Koenig has, however, seen tuberculosis develop at the seat of recent fractures; according to this authority, severe trauma is more frequently followed by tuberculosis of bone than of joints.

Applying the foregoing considerations to the study of tubercular processes in and about the knee-joint, in what manner, and to what extent, can injury influence their occurrence?

The cancellated structure of the adjoining epiphyses of the tibia and femur furnish a favorable locality for the arrest of infectious material carried along in the circulation, and is frequently the seat of tubercular foci which have a tendency to communicate by extension with, or rupture into, the knee-joint. We can readily see how an injury would favor this occurrence, either directly by the force of the trauma, or indirectly by the abnormal conditions brought about.

Traumatic synovitis with hemarthrosis, or with serous effusion and precipitation of fibrin, conditions very commonly found after injuries of the knee, seems to furnish a very favorable soil for the tubercle bacillus. The large area of serous membrane and the size and distensibility of the joint predispose to large effusions, with consequent slow absorption, thus increasing the danger of infection. It is also evident that neglect of proper treatment of the morbid conditions produced by the trauma will enhance this danger.

The importance of old tubercular foci in the causation of tuberculosis of the knee is indicated by the fact that their presence was demonstrated by Orth in over 88 per cent. of fatal cases from Koenig's clinic.

In conclusion I may state then, that according to the present state of our knowledge, the proper significance to be attributed to trauma as related to local tuberculosis is, that it prepares suitable soil and conditions for the arrest and development of the tubercle bacillus, and that such localization may take place in

consequence of a trauma, where otherwise it would not have occurred. While local tuberculosis very frequently occurs without the intervention of a trauma, and as the question of its accession depends largely on previously existing conditions and hereditary influences, and the causative relation between an injury and a subsequently developing tuberculosis can not, in a given case, be with *certainty* maintained, yet it would probably be impossible to eliminate this element in case of alleged damages by reason of tubercular disease following upon, and at the site of an injury and setting in before the evidences of such injury have disappeared. In other cases the connection is so problematic that it should not be considered as a ground for damages.

DISCUSSION.

PROFESSOR RIDLON—I came to learn and be instructed rather than to speak, but I am interested in this subject of tuberculosis of the joint, and the few words I may say would be entirely from a clinical standpoint. I have seen a fairly good number of tuberculous joints in my experience in orthopedic surgery; it seems to me that tuberculosis of the joint rarely if ever follows a serious injury unless the case is treated too much; it frequently follows slight injuries. In fractures and dislocation I have not seen tuberculosis; if unrestrained passive motion were employed by the surgeon I believe the joint would, without any question, from either fracture or dislocation, become tuberculous. But in sprains and contusions where the conditions are so slight that the physician is probably not consulted, or perhaps does not consider it important enough to treat, cases which are used while there is a little tenderness, a little stiffness, if they continue to be used and if the swelling and slight tenderness and slight stiffness remain long enough, these joints will ultimately become tuberculous. I think it depends on the individual in whom they are situated, but they do become tuberculous sooner or later if they

are allowed to go on in their slightly inflamed condition. The point then that I would like to make in this relation is this: In severe injury do not use passive motion unless you are willing to take the risk of developing tuberculosis; unless you are willing to be responsible for tuberculosis of that joint; in slight injuries, in most cases at any rate, endeavor to impress upon the sufferer the very great importance of his condition and the necessity of submitting to treatment until all symptoms of inflammation have subsided. Those are the main things that strike me in this connection as an orthopedic man. I only see those cases, gentlemen, that you do not cure. I do not see the many that you do cure.

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CHAPTER VI.—INJURIES OF THE EYE.

PERFORATING WOUNDS OF THE EYEBALL.

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Perforating injuries of the eyeball are quite common among railroad employes and occur in all forms and degrees from the slightest perforation of the cornea with the loss of scarcely a drop of aqueous humor to the complete opening up of the globe and the entire loss of all its contents. Perforating wounds of the eyeball, with few exceptions, should be looked upon as serious injuries and be treated with the care that such cases deserve. Beginning with the wounds in the anterior part of the eyeball a small cut with a clean and sharp instrument through the cornea is not generally a serious injury, unless the agent producing the wound be infected, or penetrates beyond the posterior surface of the cornea far enough to injure the iris, lens or deeper structure of the eye. But if this cut should be situated within the pupillary space, the injury would be a serious one, not on account of the danger to the integrity of the eyeball, but because the resultant scar would interfere with the vision of the injured organ. If the opening should be sufficiently large, prolapse of the iris is almost certain to occur,

followed by the dangers of infection, iritis, or deeper seated inflammations. If the ag^nt producing the injury be rough or dirty, infection is liable to be carried into the corneal wound or into the anterior chamber, setting up a suppurative inflammation which may cause loss of a part or whole of the cornea, rendering the eye useless as an organ of vision for all time to come. Wounds extending deeper injure the iris or the lens or both. With the injury of the lens another danger is added to the case. As a rule as soon as the lens or its capsule is injured it immediately begins to swell and usually causes enough irritation to set up an iritis or cyclitis. The younger the patient the less the danger of these results occurring, as in children an injured lens with proper management will often break down, disintegrate, and be absorbed without causing any serious trouble. But railroad employes are not often below the period of adult life and an injured lens in these cases is a serious matter and is capable of doing damage in a number of ways, unless properly managed, as the opacity of the lens resulting from the injury causes loss of all useful vision until the lens itself is removed either by absorption or operative measures; the swelling of the lens substance causes iritis, or cyclitis, which may result in the destruction of the eye as a visual organ, or the swelling by increasing the intraocular tension may cause a traumatic glaucoma with the bad results following non-traumatic cases of this disease. Should a wound penetrating the anterior wall of the eyeball extend beyond the lens into the vitreous there will be in addition to the trouble already mentioned, danger of hemorrhage into, and infection of the vitreous,

both of which conditions as a rule eventually cause the loss of vision, and oftentimes the latter causes destruction of the eyeball itself. The wound may not be received in the anterior wall but back in the ciliary region, or still farther back through almost any portion of the sclera, although Nature has placed the eyeball so that the posterior half is well protected from external injuries. The results following injuries in these locations will depend upon the size and depth of the wound and on the fact as to whether the instrument producing the injury was aseptic or not. If the wound is large there may be loss of the entire vitreous and lens which means loss of the eye; if the wound is small and clean cut there may be very little damage done, no loss of vitreous, almost immediate union of a wound, and no bad results. Between these two extremes will occur cases of many different degrees of seriousness. As a rule the deeper the wound the more serious it is, not only on account of the mechanical injury done, but also the liability of carrying infection to the deeper structures. But whatever portion of the eyeball is penetrated by these injuries there is another factor, not yet mentioned, which adds an extra amount of gravity to any given case, and that is the retention, within the eyeball, of the agent causing the wound. It is true that a number of cases have been reported where eyes containing foreign bodies have retained more or less perfect vision, but these cases are in a hopeless minority, are considered so rare that they are always reported, and only serve to emphasize the danger which becomes manifest sooner or later in the greater majority of these cases. In all cases of penetrating wounds of

the eyeball followed by inflammation of the deeper structures there will be more or less danger of sympathetic trouble in the other eye. The retention of a foreign body within the eyeball increases this danger. With this hurried discription of these injuries, let us pass on to the " diagnosis of penetrating wounds of the eye," which is the part especially assigned to this paper in the present discussion.

Many of the severer cases could not be overlooked with the most casual examination, the wound being so large and gaping, the lips separated by fragments of iris, lens or vitreous. There are others, however, where the wound is so small or so clean cut as to make it absolutely necessary to exercise the greatest care and caution in making the examination in order to avoid a mistake in diagnosis, and in these the following mode of making examinations will be found very useful and satisfactory.

First, the history which the patient will give of the manner in which the injury was received, the kind of agent producing the injury, shape, size, material, force, and direction from which it came, and portion of eye struck, will give one some very valuable information in regard to the case. Thus the exact point of injury is often located by the patient which might be overlooked by the examiner unassisted by the patient's description. The size and shape of the foreign body, the material of which it is composed, and the velocity and force with which it was sent will be of great importance in deciding the depth to which the wound has extended. A description of the instrument inflicting the injury often decides whether or not there is a foreign body retained in the eyeball, a

very important point indeed to be decided early; as, if the instrument is a penknife, a pin, needle, or pair of scissors, an examination of the article, finding it intact, shuts out the possibility of anything being retained within the eye. On the other hand, should the agent producing the injury be a small bit of iron, steel, brass or copper, the chances are that if not caught in the cornea, or sclera, it has passed through and lodged in some of the deeper structures of the eye and the most thorough and painstaking examination should be instituted in order to discover and locate it if this be possible. It is always best to use a biconvex lens of two inches focus in making these examinations. By using the condensing lens for oblique illumination, small punctures which otherwise would be overlooked will be brought distinctly into view. In addition to this another convex lens can be used as a magnifying glass to enlarge images and will be another adjunct in making this discovery of the slightest wound more sure and certain. The examination should begin with the cornea, which being a bloodless membrane leaves little trace of small wounds or punctures and on this account the use of the magnifying glass and oblique illumination are almost indispensible. A faint dot or line of opacity usually tells the story of injury to, and perhaps an opening through the cornea. If the wound has penetrated deeper and the iris be injured, blood in the anterior chamber and perhaps a rent in the iris itself, adds to the evidence already collected. If the point of penetration is beyond the margin of the cornea in the sclera, even the most minute puncture usually leaves a dot of blood from the conjunctiva or subconjunctival tissue to mark the point of entrance.

Blood in the anterior chamber may be the result of a penetrating or non-penetrating wound and should not be taken as conclusive evidence of the former unless the cut in the anterior wall of the eyeball can be discovered. A blow on the eyeball may cause a laceration of the iris filling the anterior chamber with blood and even dislocate the lens, without perforating the anterior wall. If the wound is in the cornea and is seen soon after the receipt of the injury the anterior chamber will be found very shallow or almost obliterated, the iris being pushed forward against the posterior surface of the cornea, the loss of the aqueous humor allowing the lens to push the iris forward. This, when present after an injury, is a positive symptom of perforation but in many cases, where the opening is small and clean cut, the wound almost immediately closes and in a few moments sufficient aqueous humor reaccumulates to refill the anterior and posterior chambers and this valuable diagnostic symptom disappears. Where the wound is larger a prolapse of the iris into the wound is positive evidence of an opening through the anterior wall. If the perforation is at or back of the ciliary region there will be prolapse of the ciliary body or choroid instead of the iris. In the larger wounds there may be not only prolapse of iris or choroid but also escape of lens, or vitreous or both. Wherever the wound is located, as long as it remains open, a valuable symptom will be present in the shape of diminished intraocular tension. This symptom is especially valuable in cases where small wounds through the sclera are hidden by bruised and swollen conjunctiva. Laceration of the sclera from a blow on the eye will present this symptom. After the

first twenty-four hours an opaque lens will often establish the fact that the eye has been penetrated and the lens injured. Cases occur when the penetrating body is very small (as bits of metal, steel, iron, brass, etc.) where the most skilled eye surgeon will be in doubt for a short time, as to whether the foreign body has passed in and remains in the eye or not. Immediate search of the anterior part of the eye with convex lens and oblique illumination and of the deeper parts with the ophthalmoscope may not reveal the foreign body or the path it has pursued, but after a short time symptoms in the shape of opacities in lens or vitreous, or inflammations of the deep structures of the eye with corresponding loss of vision will remove any doubts that may have at first existed. Briefly, then, a correct diagnosis immediately (within a few hours) after receipt of injury can usually be reached in the more obscure cases by obtaining a careful history of the accident from the patient; by close examination of exterior surface of eyeball with convex leus and oblique illumination, by noting the depth of anterior chamber, by testing the tension of eyeball, by noting prolapse of iris or any portion of uveal tract, and last, if the media be clear, the ophthalmoscope may locate a foreign body or reveal a wound in the deeper structures of the eye. Later on swelling and opacities of the lens or vitreous and inflammatory trouble out of proportion to what would be expected from the visible wound, often point out the extreme depth of the injury, or the presence of a foreign body which before may or may not have been suspected. Detachment of retina with loss of vision months after the receipt of a small wound in the sclera

may be the first positive proof of the penetrating nature of the injury. The short time alloted this paper does not allow any extended description of the management and treatment of these injuries, but as the final result depends so much on the treatment received the first few days after receipt of injury, I can not refrain from adding a few lines in regard to the early management of those cases which do not require immediate enucleation.

As there is no way of determining whether a wound is aseptic or not these cases should all be treated as septic and palpebral sac be thoroughly cleansed with an antiseptic solution and any foreign substance in the sac carefully removed. Loose ends or fragments of cornea should be trimmed off and lips of wound brought in as nice apposition as possible. Any foreign body retained in corneal wound or in interior of eye should immediately be removed if possible with forceps or magnet, though no rude probing or exploring after unseen or unlocated foreign bodies should be indulged in. If the iris protrude through the wound and is uninjured, after being thoroughly cleansed, it should be carefully replaced in anterior chamber with probe or spatula. If this can not be done or if the iris be lacerated the protruding portion should be removed. If the wound be in or near the central portion of cornea, sulphate of atropia in two to four grain solution should be used with sufficient frequency to secure wide dilatation of pupil within a few hours time so as to remove the iris from the location of the wound and thus avoid further danger of prolapse. If the opening is near the periphery of the cornea a solution of eserin or pilocarpin should be

used to prevent the iris from bulging into or through the wound After the first twenty-four hours, or as soon as the edges of the wound are adhered the myotic should be changed to mydriatic. A bandage of gauze over a light pad of cotton should be applied for support of lacerated wall and to prevent friction of wound from movement of lids. This also shuts out the danger of further infection of wound from the atmosphere, practically making a closed wound. Cold applications are indicated in all of these cases, except the very mildest and are best applied over the light dressing already described. Experience has taught me that as good results are obtained with less discomfort to the patient by the use of a small ice bag over the pad and bandage as by the use of cold in any other manner. This can be used more or less constantly according to severity of case, and obviates the necessity of the constant attendance of a nurse, which is absolutely necessary with the application in the usual way. Pain should be relieved and rest and sleep secured by the use of morphia, if necessary, as these conditions are as essential here, for the prevention of inflammation and the hastening of the reparative process, as in wounds in other portions of the body. If the wound be through the sclera and is of any considerable size, the edges should be brought together with sutures as this membrane, on account of its stiffness and inelasticity, does not allow the opening to close so that union between the lips of the wound can take place.

By following the above rules many of the milder cases, in a very few days, will be practically well, while the severer ones will be placed in the best condition

possible for the prolonged and varied treatment which they will require, a description of which would occupy more time and space than is allowed this paper.

DISCUSSION.

Dr. W. A. WARD—I am not much of an oculist and have not had much experience, but it has fallen to my lot to have four cases of penetrating wounds of the eyeball. The first was one in which a piece of steel was lodged in the cornea and was readily removed but subsequently was followed by protrusion of the iris, the protruding part was removed but the iris became blocked in the cicatrix that follows, and remains in that condition today, although the eyeball is intact and is full size. The second case was one in which one-half of the washer of a rivet as a boiler-maker was clipping it off flew into the eye; the eyeball immediately filled with blood. An effort was made to remove it with forceps, it was a failure; it was then removed by the electro-magnet. In that case recovery took place, the eye cleared up but we have a dislocation of the lens, and of course impaired vision. The third case was one almost similar arising in the same way as the second. An effort to remove by the forceps, and a failure, and the electro-magnet succeeding, but the recovery was protracted; after two months the patient complained of a scratching; I examined and found a second piece and it was removed. That case recovered, but of course with impaired vision. The fourth case was the result of an explosion of the gas tube of the oil feeder on a locomotive, and that lacerated the eye so that all of the interior eye at once exuded, and of course there was no other way than to extirpate the remaining coats of the eye. Taken these two cases, the second and third, in my next case, if I should be unfortunate enough to have another, I would not delve, especially if the eyeball filled with blood, but would use the electro-magnet at once, and then I would make free use of the boracic acid solution.

Dr. BRYANT—I can not help saying something, these cases are very important cases, and the most important part of it to my idea is the early treatment as far as the railroad surgeon is concerned. The surgeon does not intend to treat these cases through, excepting the milder cases, but he must have charge

for the first twenty-four hours, perhaps for two or three days. In my own practice I see most of these cases about the third or fourth day and some of them have not been treated at all, and in those cases so much damage has already taken place by inflammatory trouble that the results are not as good as if they had been properly treated—nothing done excepting the eye has been cleansed. If the surgeon would use the free application of cold continuously these cases would come into our hands as if we had seen them first; except in cases where the foreign body is retained in the eye, which perhaps we might remove better than the general surgeon. But even those cases can be treated by the surgeon when the foreign body is in the anterior chamber; I do not know as a rule that the surgeons have a magnet, but if the ordinary surgeon would carry either an electro-magnet or a small magnet which is strong enough to remove small bodies from the eye and occupies no space in a case, you will find you can remove most of these bodies without any trouble—in most cases the original wound is closed and we have to reopen it or make another wound, but the use of the cold and the moist dressing should always be begun immediately after the first dressing of the wound and continued for the first few days at least.

THE PERSONAL EQUATION AMONG TRAINMEN OF EQUAL OR GREATER IMPORTANCE THAN VISUAL POWER OR COLOR SENSE.

BY ROBERT TILLEY, M.D.
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After having one day examined a few locomotive engineers for visual power and the color sense in particular, I felt considerably dissatisfied and asked myself the question, what is the object of these examinations? The answer came immediately: To avoid accidents by the elimination of men with visual defects. Another question presented itself: But is this—the condition of the color sense and the visual power relative to form—all that can afford us information relative to the aptitude of the individual to perceive quickly and respond with judgment? Emphatically, no. There is another phenomenon, or rather several phenomena, the observation of which would add much greater certainty to our work and more personal satisfaction in its contemplation. These several phenomena consist of the time taken for the sensation to be carried from the retina through the optic nerve to the cortical substance of the brain; the time taken for comparison and ratiocination; the giving order for action and the execution of action.

The whole of these several operations takes but a very short time, but it is only a very short time, a

small fraction of a second that determines an accident or an escape from the same. This fraction of time and its importance has been recognized by astronomers ever since serious calculations by different individuals have been made, and has been called the "personal equation," and it is only by taking notice of this fraction of time that their calculations can be made to agree. I have little doubt, gentlemen, that you will recall instances of marked rapidity of action and marked slowness of action, the latter being by far the most readily noted. I have been told of a case where the length of time taken up by the phenomena referred to above was so great that it was unsafe for the individual to venture out alone. There is no danger of such extreme cases being found among trainmen.

Now the exhibition of the instrument by which it is proposed to measure this personal equation is of very much greater importance than any collection of words attempting to discuss the matter. Consequently I am extremely sorry that it has been impossible to get the instrument here to exhibit to you. But all of you know the numerous unforeseen circumstances which arise in any original work. I know Mr. Bush of Rochester, who is making it, tried his very best to get it here.

The instrument at present is in appearance like an old clock, only about one-half or two-thirds the height. Accompanying it on a table is a small case supplied with keys corresponding to the red, green or white objects which will be made visible at will by the examiner. This small case is witnin easy reach of the person being examined. In the large

case near the top is a hole, across which is made to pass an object, white, green or red. The man being examined is requested to observe and touch the correspondingly colored key on the instrument on the table; and the time that elapses from the moment the object passes the hole in the large instrument to the time when the key is touched is the man's personal equation, which is shown by a line which is begun at the moment the object passes the large hole and is stopped at the pressure of the key. The length of this line is easily transformed into the fraction of a second. If a mistake is made by touching a green key when a red color appeared, or *vice versa*, that is recorded.

That is a very crude description of the external appearance of the device. The inward working, the instrument not being here, is omitted.

An instrument like this means a good deal of preliminary work before it is easily and readily applied. The average personal equation will have to be ascertained and may become a recognized item like the visual acuity. When the instrument is thoroughly mastered it will be a practical and useful instrument.

I am disposed to think that it will detect and show up a class of cases which not infrequeutly applies for personal damage without any real claim. I am interested in one such now on hand.

In 1892 I was asked to examine a man relative to his visual acuity. He claimed to have suffered a loss of vision in connection with a wound in the forehead. The report was that there was incipient atrophy—that in all probability it had nothing whatever to do with the accident—but that with the claim that vision was

perfectly good beforehand and no proof to the contrary it would be very difficult to demonstrate to a jury that it was not caused by the accident.

There was a settlement made and now as he is blind, he brings suit again, claiming that he did not know what he was doing.

Now it is not at all unlikely that this is a form of atrophy associated with locomotive ataxia and that as the perception of sensation is often retarded in such cases, it is very probable that the claimant being examined by some such device as this within twelve months prior to the accident, he would have been relieved of his duties and the accident prevented.

DISCUSSION.

Dr. D. C. BRYANT—I believe it is important to examine all these cases, not only in regard to color vision, but also as to the quickness with which they can perceive colors, and even more than that, the errors of refraction. On our own road within the last few years we have turned off a great many of the old engineers on account of the errors in refraction. In our own case we have been using something with which we can get at the quickness of the recognition of colors by which the employes could be tested. We have an electric light and flashing colors, which is much better than the old way of testing with colors and better than the permanent light—often a quick perception of colors prevents a smash-up. This has been employed for several years. One fault I find with the company, they do not have their men examined often enough and not enough of the men examined; the brakemen, conductors, engineers and firemen should all be examined, not only as to colors, but as to quickness in perceiving colors. With our own road nobody is obliged to be examined excepting the engineer; this is really an injury to the firemen as they spend from three to four years firing and then on being examined for engineers they are shut out for being color blind or on account of errors of refraction; whereas if they had been examined they would have spent their time in some other and perhaps higher position.

PENETRATING WOUNDS OF THE EYEBALL.

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The title assigned to this paper is so comprehensive in its scope, that I do not presume to touch upon all the phases which it might present, but will endeavor to emphasize such points as present themselves to my mind with especial force after a careful review of the available literature on the subject. It may be that I shall speak of some things common place and trite to many, but I do it without apology for the reason that the eye is so commonly misunderstood and consigned to the recuperative powers of nature. In injuries of the eyeball as in injuries of other parts of the body, much depends upon the first dressing the wound receives. The principles of aseptic and antiseptic surgery should be carefully followed in all their minor details. Wounds of the eyeball are so varied in their nature, that we shall consider them under separate headings.

1. Wounds of the cornea. By far the greater number of every surgeon's traumatic eye cases are injuries to the cornea by the presence of a foreign body. The indications in these cases are very clear. The eye should first be cleansed with a saturated boric acid solution, then cocainized and the foreign body removed by a spud or needle, with a minimum amount

of injury to the cornea. If the injury is slight a weak antiseptic collyria dropped into the eye for a day or two and wearing of smoked glasses will be all that is required. If more extensive a compress and bandage, the application of heat or cold, whichever is more acceptable to the patient, with the use of eserin or atropin will add to the patient's comfort. If the offending agent enters the eye while hot my experience has taught me that it is quite as important to remove the brownish char as it is to remove the particle of iron, steel or emery which caused it. I have frequently seen very unpleasant sequelæ where this was omitted, and desire especially to emphasize this little precaution.

When the projectile is lodged in the cornea but penetrates the anterior chamber it can be removed by the keratotome or curved needle. If it falls into the anterior chamber it should be removed at once by an iridectomy; should it fail to escape with the aqueous it will be easily removed with the iris forceps.

Wounds of the cornea show a tendency to heal kindly. This has been conclusively demonstrated by the many operations which are made in it to reach the interior of the eye. Wounds accidentally inflicted are, however, not always clean cut and their edges not easily kept in perfect apposition. Asepsis and apposition are the two principal points upon which primary union in wounds of the cornea depends. These simpler wounds of the cornea carefully treated usually heal without a visible scar.

2. Injuries of the cornea involving the iris and lens. "Penetrating or incised wounds of the cornea are very generally followed by prolapse of the iris.

The extent of the protrusion varies with the size and position of the wound. A small penetrating wound near the corneal margin is more likely to be attended with prolapse than a larger incised one near the center. The amount of prolapse to a certain extent is dependent on the size of the wound; but beyond one of a limited range, such as is produced by the point of a pair of scissors or the blade of a penknife, the tendency to prolapse is diminished as the size of the wound is increased.[1]"

Prolapse of the iris always constitutes a formidable complication and usually taxes the surgeon's ingenuity to decide which of the two plans of treatment to pursue, operative or non-operative. The latter we think should always be given a trial. After the wound has been thoroughly cleansed the iris may be replaced with a spud.

A solution of eserin or atropin according to the location of the wound should then be applied to put the iris in a splint as it were. If the iris can not be retained in place by this method, recourse to the method of Gama Ponti can be taken[2]; this surgeon abscises the prolapsed portion of the iris, frees all adhesions to the margin of the ulcer, and covers the opening in the cornea with a flap of bulbar conjunctiva, which should be cut twice as large as the opening and pushed into the orifice with a blunt probe. A firm binocular bandage is applied, and the eye not dressed until the third day. Then it will often be found that the conjunctival flap has healed into the ulcer. A flat non-adherent cicatrix results, or in other words, an ordinary corneal scar without staphy-

[1] Lawson: Injuries to the eye, page 114.
[2] Schweinitz: Ophthalmic Record, June, 1896.

lomatous bulging and a circular pupil. Dr. Schweinitz reports several gratifying results by this method.

If the lens or its capsule is injured there will in all probability be developed a traumatic cataract. The point of injury is within twenty-four hours indicated by an opaque patch, which gradually increases until the whole lens becomes opaque. The rapidity of the formation of a cataract will depend partly on the extent of the injury, and partly also on the age of the patient. If the rent is large and the substance of the lens broken into, the aqueous humor will come rapidly in contact with the lens substance and its transparency be quickly destroyed. If the rent is small the development of the cataract will be very much more slow. It occasionally happens, but this must be considered exceptional, that a small wound of the lens capsule produces only a limited opacity. In relation to injuries to the lens Dr. J. Hirschberg of Berlin reports two cases of very especial interest at this point.[3] The one a boy 14 years old, who while exploding a gun cap was struck in the left eye with a portion of the cap, the copper particle being easily visible in the lens, and the opacity being limited to the immediate site of the foreign body. The other a man 46 years old, who while discharging a gun was struck in the right eye by a piece of the gun cap. In the outer layers of a perfectly transparent lens could be seen a copper splinter 5 to 6 mm. in length. Only a light gray cloudiness of the lens capsule immediately over the foreign body was discernible. Of these two cases Dr. Hirschberg says the copper splinter in the lens was well borne for months and years without the develop-

[3] Deutsche Med. Woch., 1894. No. 14.

ment of a disturbing cloudiness; the eye read the finest print, and did not require operation.

Slight injury to the lens or capsule may, however, result in so stormy a swelling of the lens that the safety of the eye demands its immediate removal. This operation usually terminates happily.

3. Injuries to the ciliary region and the sclerotic. "A wound of the cornea even though the lens or iris be implicated, is less fatal to the eye than a similar wound in the sclerotic." The hemorrhage in the former instance, is into the anterior chamber, and mixing with the aqueous humor it is rapidly absorbed; whereas in the latter, if hemorrhage ensues, it is into the vitreous, and frequently also between the choroid and retina. Blood in the vitreous is slowly absorbed, while irreparable damage is done to that portion of the retina which has been displaced by a blood clot. Wounds of the sclerotic sometimes heal with difficulty, and the difficulty increases as the location of the wound recedes from the margin of the cornea. This is probably occasioned by the fact that the margins of the wound remain patulous, the tissues of the sclerotic refusing to yield to the diminished size of the vitreous within it; hence it is that wounds in the sclerotic where only a small quantity of vitreous has escaped, there is a tendency for the lips of the wound not to come together, and a consequent inability for primary union. These wounds, however, unite quickly if the edges are brought in apposition by a fine silk suture. Dr. Bowman reported two cases illustrating this fact. "In the first patient there was a wound in the sclerotic which had remained patulous for three days, and in the second, no attempt at union had taken

place one week after the accident, yet, in each case, immediate union followed after the edges had been brought into accurate apposition by a single fine suture." The occasional cystoid cicatrix, which is found, could, we think, be avoided by recourse to suturing. The danger of a wound to the eyeball is immensely increased, if the injury is located in the sclero-corneal region involving the ciliary body. The risk to the injured eye is very great, but the chief danger is the chance of the other eye becoming involved in a sympathetic ophthalmia.

Lastly, we come to consider briefly that class of wounds in which the projectile remains within the eyeball. Every penetrating wound of the globe should be especially examined with reference to the possibility of there being a foreign body within the eye. The history of the case should be carefully gone into with a view to ascertaining the exact nature of the material which struck the eye, whether large or small, by what force and in what direction it was propelled against the eye. The eye itself should be examined first superficially, then the iris and lens. If the wound in the cornea suggests the possibility that a foreign body may have penetrated it, and yet the foreign body is not visible in the iris or lens the pupil should be dilated with atropin to bring the lens into full view, because it may have lodged in the margin of the lens and behind the iris. Oblique illumination is of immeasurable value in this examination of iris and lens. If such an examination does not reveal the foreign body, and the conditions are favorable, a thorough ophthalmoscopic examination of the whole fundus should be made, and the foreign body located if

possible. Unfortunately, however, these injuries are sometimes attended by hemorrhage, which entirely obstructs the view of the interior of the eye. Dr. Rohmer[4] in a very able article on "Extraction of Metallic Foreign Bodies from the Posterior Segments of the Eye by the Electro-magnet," says: "When a foreign body reaches the deeper parts of the eye, it will cause disorder varying in intensity and gravity according to its size, the region of its entrance, its degree of cleanliness, its chemical composition, the place which it occupies, and its action on the neighboring parts. After its penetration, the eye may be immediately and irrevocably lost from the extent of the lesion, escape of vitreous, hemorrhage or infection. Or the foreign body entered by a very small opening, and only caused an insignificant lesion, with partial or complete preservation of vision."

The location of a foreign body in the eyeball will in a measure determine the degree of tolerance, the different structures reacting differently to its presence. In the lens, for instance, a small foreign body may be borne well for years, and be ultimately removed with the schriveled and hardened cataract. In the posterior segments, however, a foreign body will rarely be tolerated. In the vitreous, choroid, and ciliary body, even though the foreign body became encapsulated there will sooner or later develop a plastic or purulent inflammation, with consequent destructive ophthalmitis.

The treatment of these cases will depend upon the nature of the foreign body. Coppez made the observation that in seventy cases of foreign body in the

[4] Annales d'Oculistique, March, 1896, p. 174.

posterior hemisphere of the eye, forty-two were iron or steel, ten were lead-shot, ten fragments of cartridges or pieces of copper, six fragments of stone, one zinc, one wood.

If the foreign body is magnetizable it should be removed as soon as possible after the accident with the electro-magnet. From the statistics[5] gathered at the clinic in Zurich by Hirschberg it is apparent that during the four years preceding the use of the electro-magnet in cases of metallic fragments in the vitreous, there were twenty-four cases treated, all of which were recorded as failures, that is, 100 per cent. During four succeeding years in which the electro-magnet with antisepsis were employed, of thirty-five cases there were only twenty-four failures, that is, 68 per cent. In his own practice without the magnet he did not have one successful case, during the first ten years. In the following ten years with a magnet, of thirteen successful cases, seven were noted as satisfactory, and six as mediocre. These figures certainly justify the use of this method, and we need not discuss this proposition at greater length.

If the foreign body is not magnetizable, the eye should be enucleated as soon as there are signs of obstinate inflammation.

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[5] Hirschberg: Centralbl. f. prak. Augenclinik, 1894, p. 281.

PENETRATING WOUNDS OF THE EYE; THEIR PROGNOSIS, DIAGNOSIS, AND TREATMENT, WITH ESPECIAL REFERENCE TO RAILWAY EMPLOYES.

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Possibly next in importance to the question of life and death which we as surgeons will be called in to decide is that of total blindness. This appeals especially to us as railroad surgeons in the treatment of penetrating wounds of the eyeball. Injuries of this charcter are frequent, and as the majority of patients are of the working class, the loss of this function not only disqualifies them for any useful occupation, but makes them burdens of society and inmates of asylums.

We are all familiar with the disastrous termination in sympathetic disease that closes the history of many cases of injuries of the eye. Although this now appears to us rather as a bad dream, with the more improved methods of treatment and antiseptics which we have at our command, yet no surgeon treats a severe penetrating wound of the eye that this ghost does not stand before him. Therefore we should not hesitate to use every means, including the radical operation of enucleation, to prevent this fatal complication.

Cohn's statistics give a good idea of the frequency of the injuries to which the eyes of many workmen are exposed. Among 1,283 workers in metals employed in six factories, each man received an average of from two to three eye injuries a year. Of course, the majority of these injuries were of slight character; most, indeed, consisted merely in the penetration of small metallic particles into the surface of the cornea, which were for the most part removed at the factory itself. About half of the workmen were required to seek medical aid, thirty-six suffered a partial impairment of sight; and sixteen (that is, 1.2 per cent. of the whole number) each lost one of the eyes.

Diagnosis.—The most important subdivision of the subject of penetrating wounds is the diagnosis. Only by the careful study of individual cases can the treatment be successfully and intelligently carried out.

To facilitate this study I propose to divide the eye into three regions—anterior, middle and posterior—thus making a topographical division rather than an anatomical one, that, while possibly not so accurate, will better serve our purpose.

In the first or anterior region are included the cornea, lens, iris, anterior and posterior chambers. Of the three regions wounds here are the least dangerous. By the word "dangerous" I mean wounds that are followed by complete loss of one eye or secondary involvement of the other. Of course, there will be impairment of vision corresponding to the extent of injury; for example, wounds of the lens are almost invariably followed by a cataract; but panophthalmitis and sympathetic ophthalmia are comparatively rare. You will note that I have included the iris in this region,

and although injuries to it are much more dangerous than those to any other structure in this portion of the eye, yet if the wound does not include the periphery of the iris, and the iris be not extensively prolapsed, you will find that it will readily heal. One of the causes of this region being less dangerous is that it is less liable to become infected as the outflowing aqueous humor washes away the germs which may have been introduced into the wound, and the prolapse of the vitreous which always occurs in wounds farther back is a most favorable medium for the growth of micro-organisms.

Signs.—The signs of penetrating wounds in this region consist in diminution of tension until the wound is firmly closed, loss of the aqueous and forward dislocation of the iris. If the wound is extensive there will certainly be prolapse of the iris. If the iris is simply bruised we have blood effused into the anterior chamber. Wounds of the lens can be seen either by the ophthalmoscope or by oblique illumination. They are associated with pain and inflammation.

The second or middle region—the ciliary region. This is described by Nettleship as the "danger region" of the eye. This region comprises the ciliary body, anterior portion of the retina, choroid and vitreous, and approximately consists of the sclero-corneal junction, and that portion of the eye about a quarter of an inch posterior to it. Wounds of this region are the most dangerous of any portion of the eye, and the prognosis is always grave. Symptoms of wounds of this region consist of loss of tension until the wound is closed; if associated with corneal wound the anterior chamber is abolished, the iris pushed forward; if

the wound involves the sclera, and we have loss of vitreous, the iris may be retraced with deepening of the anterior chamber and hemorrhage into the vitreous. The ciliary body and choroid are most frequently prolapsed into the wound, as shown by a darkly pigmented mass projecting from it.

The third or posterior region. This consists of the remaining portion of the eye posterior to the area designated as the ciliary or middle region. It consists of the sclera, choroid, retina and vitreous. Wounds of this region are very much more rare, and are less disastrous than those of the ciliary region, but far more so than wounds of the anterior region, as prolapse of the coats of the eye is more likely to occur, and infection more difficult to prevent. Also secondary changes take place in the wounded eye due to the contraction of the cicatrices of the wound. The symptoms here consist in loss of tension, retraction of the iris from loss of vitreous, hemorrhage in the vitreous, inflammation, pains, etc.

All penetrating wounds must be studied carefully both by objective and subjective means, aided also by instruments at our hands, such as the ophthalmoscope and condensing lens. The history of the case must be gone into most carefully; how the injury occurred, the direction from which the foreign body came that produced the wound, its size, its composition, whether septic, and finally, whether the wound is complicated or uncomplicated by the presence of a foreign body.

Small incised or lacerated wounds of the eye may be made by either large or small bodies. If we have to deal with a penetrating wound, and can learn that it was produced by a small flying piece of steel, we

are moderately confident, even without the aid of the ophthalmoscope, that the foreign body is within the eye. On the contrary, if it is made by a knife, an awl, or tool of some character, we are sure that the injury is not thus complicated.

Much depends upon the composition of the foreign body producing the wound. Leber, by his experiments, has shown that some metals can produce severe purulent inflammation even if introduced into the eye aseptically, and that the inflammation following such injuries may be due not to a micro-organism that may gain access to the wound, but the chemical action of the metal introduced. Copper is preëminently dangerous to the safety of the globe. Iron and steel, although offering probably the best prognosis for their removal, produce irritation, since they are subject to oxidation. Lead and other chemically indifferent bodies, such as glass, stone and coal, as they are not decomposed, produce irritation mechanically, and by the fact that they carry the micro-organisms with them. Splinters of wood are among the most nocuous of foreign bodies.

As to whether the wound is aseptic or not: Inflammation is excited by the presence of micro-organisms which make their way into the interior of the eye from the conjunctival sac, either along with a foreign body or subsequently; if a small incised wound is made by a clean instrument, such as a pin, a knife, etc., purulent inflammation is rare.

In injuries made by shot the combustion of firing the powder makes the shot generally aseptic. Orio, of Padua, has shown this by his experiments reported at the meeting of the Italian Ophthalmic Society last

year. He fired with pistol, shot previously infected with pyogenic micro-organisms into eyes of rabbits, and into culture-tubes. In no case did the micro-organisms develop. He, however, placed some of these shot in eyes and culture tubes with almost immediate development of micro-organisms. This has been my experience. I have seen several cases in which small shot penetrated the ball without producing severe inflammation.

Landolt has found from his observations of the patients that injuries produced by explosions of dynamite are aseptic for this same reason. Small pieces of iron and steel, if red hot, enter the eye aseptically. As I said before, if inflammation follows it is produced by chemical action. Large foreign bodies producing lacerated wounds and disorganization of the eyeball are liable to be followed by subsequent inflammation.

Wounds Complicated and Uncomplicated by a Foreign Body.—If the case is seen shortly after the injury, and there is no wound of the lens and the vitreous not too full of blood, we are often able to locate the foreign body by the ophthalmoscope. If this fails, through the reasons above stated, we must then depend upon the history of the injury, and the character of the foreign body which produced the wound,—in other words, diagnosticate it by exclusion. If, however, the patient can not give us any clear account of the accident, owing either to ignorance or, as it often happens, to unconsciousness from the violence of an explosion, as to whether or not the foreign body has entered the eye and remained there, it may be put down as a good rule that if the inflammation

is disproportionate to the trauma alone, we may be almost confident of the existence of the foreign body within the eye.

Finally, the discovery of the X-rays which have been so valuable in aiding the diagnosis in surgery, will also be of great service in determining in some obscure cases not only the presence of the foreign body, but its location, which will aid greatly in its removal. There have been several successful cases reported. This is, however, a procedure that will hardly be required in the majority of cases, but when all other methods of diagnosis fail it should certainly be used.

Prognosis.—Possibly the most important point of the subject of penetrating wounds is after we have carefully diagnosticated the case as to the character of the wound, the foreign body producing it, etc., to decide the fate of the eye and possibly that of its fellow.

The dangers which stand paramount before us in case the tunics of the eye are opened are: First, that infection may take place and the eye be lost by panophthalmitis; second, that sympathetic ophthalmia may develop in its fellow eye-ball, with loss of both eyes; third, if the tissues are prolapsed and caught in the scar, or a foreign body remains in the eye, although the wound may be healed there is always danger, even in years to come, of subsequent changes taking place in the wounded eye, such as detachment of the retina due to cicatricial contraction, degeneration of the wounded tissues, or recurrent attacks of inflammation that may be followed by blindness in the other eye caused by a slow form of iridocyclitis.

The prognosis in all these cases of wounds depends upon the location of the injury, whether infection has set in, and whether or not the foreign body producing the injury is still in the eye. As regards the location nothing further should be said, as I have already stated in speaking of the three regions, the ciliary is by far the most dangerous. As we do not know for the most part whether or not the foreign body producing the injury is aseptic, the prognosis should be exceedingly guarded for a few days. If, however, inflammation sets in, the eye is almost invariably lost. When the foreign body remains in the eye after the injury, the prognosis is almost absolutely unfavorable. There are many cases reported where the foreign bodies have been carried within the eye for years without giving the slightest trouble. These generally find lodgment in the coats of the eye or are encapsulated, but in view of the excessive frequency of the injuries, the number of these cases is comparatively small; and even in these cases the safety of the eye is by no means to be considered permanently assured.

As Berry says: "No doubt eyes have been sacrificed, from the fear of sympathetic ophthalmia, that might have been retained or restored to useful vision; but it would take many of these mistakes, in which there will always be a doubt as to whether the eye might after all be safely left, to justify the self-reproach which the opposite mistake must cause in any one who is properly alive to his responsibilities."

The practical point for railroad surgeons to consider is, What shall be done under the conditions indicated? I have already stated the dangers that face us as regards the wounds of the eye and also the conditions

upon which the prognosis depends. It remains to point out the course to pursue.

Sympathetic irritation, although not always followed by sympathetic inflammation necessarily, yet undoubtedly in the majority of cases may be considered a prodromal stage, from which sympathetic inflammation will develop sooner or later.

The symptoms of irritation are pain and tenderness, especially over the ciliary region; pericorneal injection, photophobia, lachrymation, inability to do near work from accommodative weakness and redness of the disc. When the eye presents these symptoms following an injury to the other eye, sympathetic inflammation may develop in a few days or few weeks. The usual time is, however, about four to eight weeks. It has been known to occur as early as two weeks or as late as forty years after an injury.

If any injury to one eye is followed by these symptoms in the other, and the vision is absolutely gone in the exciting eye, it should be enucleated. If there is still some hope of vision in the exciting eye, it should be watched and treated most carefully, and at the same time the sympathizing eye treated by rest in a dark room, atropin and mercurials.

In cases where the injuries are so extensive that the sight is obviously lost, especially when complicated by the presence of a foreign body that can not be removed without too much damage to the eye, enucleation should be promptly resorted to, and especially in railway cases, as the majority of patients that come under our care can not be kept under prolonged observation; they also belong to the class not readily recognizing the danger symptoms which come on so

insidiously in this disease; also enucleation removes all dangers of sympathetic ophthalmia, cuts short a protracted illness and allows the man to return to his occupation.

In cases in which sympathetic ophthalmia has developed, and there is reason to believe there is hope of vision in the exciting eye, it should not be excised, since eventually the better vision may be restored to the exciting eye.

In cases where sympathetic irritation develops in an eye arising from a presence of an old stump, before any operation is done the refraction should be carefully tested, as several times I have seen serious symptoms disappear with a good correction of the ametropia.

In speaking of the treatment I shall observe the same scheme as spoken of before—that is, dividing the eye into three portions and taking each up separately.

Treatment uncomplicated by foreign body.—Penetrating wounds of the cornea, if made by a sharp instrument and not infected or very extensive, are comparatively free from danger and heal by first intention. In these cases the eye should be thoroughly irrigated with an antiseptic solution, boric acid or bichlorid of mercury (1: 8,000); if the wound is lacerated the edges should be replaced and touched with formalin, about 1: 1,000, or pyoktanin 1 per cent.; and a mydriatic or myotic, depending upon the position of the corneal injury, should be used with pressure bandage. If much, inflammation should be combated with ice compresses.

If the wound involves the iris or if the iris prolapses, if the case is seen very early, the prolapse

should be removed if possible by either a mydriatic or myotic. If, however, this procedure is not successful, as often happens, the prolapsed iris should be excised and the wound treated the same as a corneal injury.

In wounds of the lens the first indication is to combat the inflammation which usually follows the injury. Ice compresses are the most serviceable against impending inflammation and also against the great swelling of the lens. Removal of the lens should be performed only when through its great swelling it is itself the cause of inflammation or increased tension. Otherwise it is better to put off the operation until later, lest the inflammatory symptoms be aggravated or brought on anew by it. If the wounds in these structures are complicated by the presence of a foreign body, the first indication is to remove it, if possible, unless the removal threatens to cause too much destruction of tissue.

Penetrating wounds of the cornea.—You rarely find the foreign body in the cornea, unless it be a sharp instrument like a pin or needle, which must be removed; more commonly it remains in the anterior chamber. If the wound is large enough it can be removed by a small forceps or electro-magnet; otherwise an opening should be made in the cornea and the foreign body removed through it. If it finds lodgment in the iris it may be removed by small forceps, or as is more generally the case, a small iridectomy must be done for its removal.

If lodged in the posterior chamber iridectomy and a magnet and forceps may remove it. If it finds its way into the lens this is the most favorable position

as regards the safety of the eye. If there is not too much swelling of the lens, the foreign body should be left and later extracted with the lens by the ordinary cataract operation.

Wounds of the posterior portion and the middle portion of the eye.—These injuries are more serious, due to the more frequent prolapse of the coats, and in these cases the eye should be made scrupulously clean. If the wound is large it should be stitched with fine catgut sutures, preferably through the superficial layers of the sclerotic; the wound should then be irrigated with a solution of some antiseptic (1 :8,000); at the first sign of general inflammation the ball should be enucleated.

Pain, etc., should be treated by mydriatics and opiates. If the injury is complicated by a foreign body this should be removed if possible, either through wound or opening made in sclerotic. If steel or iron, it should be removed by an electro-magnet; other substances should be removed by the forceps. These cases generally come to enucleation, however.

DISCUSSION.

Dr. Ortega—I would like to call attention to a little point in the very interesting paper of this gentleman—he says it is very necessary to use much cleanness in and about the eye to remove anything in the cornea, and then he says to use a thin knife or pin. That I think a septic instrument. I always use a little feather toothpick; this is aseptic; I cut it fine and clean at once. I apply a solution of cocain, 2 per cent. As soon as that is done I cut my toothpick and I see that it is perfectly clean; and this instrument is sure enough, it is safe, it does not break at all, and it will take out all the pieces of stone, coal or steel that stick in the cornea; with this I can not scratch, it is perfectly smooth; after that I put a bit of iodoform on a small bandage of cotton and let the patient go home, and leave it

three or four days and then he can take it off and be perfectly well. I have treated two or three hundred patients in this way and have never seen the patient again because he is always in good condition.

Dr. THOMSON—I think the Doctor must have misunderstood me as to removing particles with a pin or pen-knife. I said in case of small injuries made in the cornea, such as a pin or knife, inflammation rarely sets in; not that I would remove it with a pin or knife.

CONSTITUTION AND BY-LAWS

OF THE

AMERICAN ACADEMY OF RAILWAY SURGEONS.

Adopted at Chicago November 9, 1894, and as Amended September 25, 1896.

NAME.

1. The name of this organization shall be "The American Academy of Railway Surgeons."

OBJECTS.

2. The objects of this Academy shall be the improvement and advancement of Railway Surgery by means of the study of the subject in general, and especially by the study and investigation of Clinical, Medico Legal and Sanitary matters relating thereto; by the reading and discussion of papers in convention, and the cultivation of closer fraternal relations amongst those actively engaged in this special work.

MEMBERSHIP.

3. The members of this organization shall be known as "Fellows," and shall be divided into two classes, namely, "Active" and "Honorary." The list of Active Fellows shall be limited to two hundred (200) Railway Surgeons, and shall be restricted to those in actual service as such at the time of their election.

No Fellow shall continue as an Active Fellow after having severed his connection with a railway company, but he may become an Honorary Fellow by a vote of the Academy, as herein provided. Honorary Fellows shall have the same privileges as Active Fellows, excepting the right to vote, hold office, and participate in the Executive Sessions.

The list of Honorary Fellows shall at no time exceed one hundred (100), and shall be composed of such Surgeons and

Physicians, and reputable members of allied professions, as may be elected at any regular meeting by a two-thirds ($\frac{2}{3}$) vote of the Academy, provided that after the year 1894 not more than five (5) Honorary Fellows shall be elected at any annual meeting.

PENALTIES.

4. Upon a sufficient showing that a Fellow has been wilfully guilty of gross violation of the laws governing the Academy, or any form of professional misconduct, the Executive Board may recommend that his resignation be requested, or move his suspension or expulsion. A majority vote of the Fellows present at an Executive Session being necessary to fix the penalty.

OFFICERS.

5. The officers of the Academy shall consist of—

A President,
Two Vice-Presidents,
A Secretary,
A Treasurer,
An Editor,
An Executive Board of seven (7), including the President, the Secretary and the Treasurer, who shall be *ex-officio* members thereof.

ELECTIONS.

6. Applications for Fellowship shall be made in writing to the Executive Board, signed by three (3) Active Fellows who are personally acquainted with the candidate. Upon a favorable report by the Executive Board, a ballot shall be ordered, when, if not more than three (3) negative votes appear, the candidate shall be declared elected.

The officers of the Academy shall be elected on the last day of each Annual Session by ballot; a majority vote of the Fellows present being necessary to a choice.

MEETING.

7. The Annual Session of the Academy shall be held at such time and place as shall be designated by a majority vote at the previous Annual Session; and each session shall continue for three (3) days, unless otherwise ordered by the Academy.

An Executive Session for the transaction of business shall

be held on the morning of the first day of each Annual Session, none but Active Fellows of the Academy being present.

BY-LAWS AND RULES OF ORDER.

1. The President shall preside at all regular meetings of the Academy, sign all official documents, and perform the ordinary duties appertaining to his office. In his absence one of the Vice-Presidents shall occupy the chair, in the order of seniority; or, if both of them are absent, by a Fellow elected by the Academy.

The Secretary shall keep a correct record of the proceedings of the Academy, give notice of the time and place of all meetings, receive the signatures of Fellows, sign official documents and take charge of all property of the Academy not otherwise provided for.

The Treasurer shall receive all money paid into the Academy, and disburse it upon the authorized order of the President and Secretary. He shall make a full report, and his accounts shall be audited by a select committee appointed for that purpose at each Annual Session.

The duties of the Editor shall be those ordinarily pertaining to such an office. He shall edit all the papers and discussions, and see that they are published as directed by the Academy. He shall act as a member of the Publication Committee, consult with said committee regarding the publication or exclusion of any paper or discussion submitted to him for publication, and assist in securing papers for each annual meeting, and the proper arrangements of the same on the program, and such other duties as may be assigned him by the Committee on Publication.

EXECUTIVE BOARD.

2. At the Annual Session of the Academy in 1894, four Fellows of the Executive Board shall be elected—one to serve one year, one to serve two years, one to serve three years, and one to serve four years; at each Annual Session thereafter one member of the Executive Board shall be elected to serve four years. The functions of the Executive Board shall be both judicial and executive; it shall have the general supervision of the affairs of the Academy; it shall recommend candidates for

membership in the Academy, and it alone shall have power of moving their expulsion or suspension for any alleged offense against the Constitution or By-Laws. It shall act as a Committee on Credentials, hold any necessary meetings in the interval between sessions, and its action shall be deemed the action of the Academy unless reversed by that body.

COMMITTEES.

3. *Committee on Transportation.*—At each Annual Session the President shall appoint a Committee on Transportation, consisting of three (3) Fellows. It shall be the duty of this committee, as far as possible, to arrange with the various railway companies for the transportation of the Fellows of the Academy to and from the Annual Session. They shall cause the publication of a list of railways granting transportation, and other necessary information.

Committee on Publication. — The President, Secretary, Treasurer and Editor shall constitute a Committee on Publication, to which shall be referred all papers, reports and other matter suitable for publication by the Academy.

Committee of Arrangements.—A Committee of Arrangements, consisting of three (3) Fellows, shall be appointed by the President at each Annual Session, the chairman of which shall reside in the place where the next Annual Session is to be held. This committee shall confer with the Committee on Publication in the preparation of the program for the next Annual Session, a copy of which shall always be sent to each Fellow at least one month before the opening of the Session, and shall make all necessary preparations for the meeting of the Academy.

SCIENTIFIC WORK.

4. The Scientific Work of the Academy shall be divided into

1. Surgical,
2. Medico-Legal,
3. Sanitary.

All papers and reports of discussions shall become the exclusive property of the Academy, subject to such disposition as shall be ordered by the Committee on Publication.

MEMBERSHIP FEE.

5. The admission fee shall be five ($5.00) dollars, to be paid

when the application is made. Should an applicant fail of election, this fee shall be returned to him.

DUES.

6. The annual dues shall be five ($5.00) dollars, payable on or before the last day of the annual meeting. Neglect or failure on the part of any Fellow to pay his dues shall forfeit his right to vote or receive the perquisites of the Academy until his dues are paid; and failure to pay his dues in thirty (30) days after the annual meeting shall forfeit his Fellowship.

QUORUM.

7. Any number of Fellows present at the appointed time of the Annual Session shall constitute a quorum for the transaction of ordinary business; but for the election or expulsion of Fellows, or for altering the Constitution or By-Laws, twenty-five (25) Fellows shall be required to form a quorum.

ORDER OF BUSINESS.

8. 1. Call to Order.
2. Addresses or other special exercises as prepared by the Committee of Arrangements.
3. Reading Minutes of Previous Meeting.
4. Reports of Officers and Committees.
5. Miscellaneous Business.
6. Announcements.
7. Reading Reports of Cases and Exhibitions of Patients, Specimens, Apparatus, etc.
8. Reading and Discussion of Papers.
9. Unfinished Business.
10. Election.

RULES.

9. Roberts' Rules of Order shall govern the deliberations of the Academy.

AMENDMENTS.

10. Proposed amendments to the Constitution and By-Laws must be offered in writing, at a regular session, and shall not be acted upon until the next ensuing Annual Session, when a two-thirds ($^2/_3$) vote of the Fellows present shall be necessary to adopt.

OFFICIAL ROLL OF FELLOWS

OF THE

AMERICAN ACADEMY OF RAILWAY SURGEONS.

Dr. David C. Ainey, Assistant Surgeon, D. L. & W. R'y, New Milford, Pa.

Dr. F. K. Ainsworth, Surgeon, Southern Pacific R'y, Los Angeles, Cal.

Dr. E. Wyllys Andrews, Surgeon, Wabash R'y, Chicago, Ill.

Dr. W. W. Appley, Surgeon, N. Y , L. E. & W. R'y, Cochecton, N. Y.

Dr. H. A. Argue, Surgeon, Erie R'y, Corning, N. Y.

Dr. S. C. Baldwin, Surgeon, G. S. L. & H. S. R'y, Salt Lake City, Utah.

Dr. J. F. Bancroft, Chief Surgeon, U. P. D. & G. R'y, Denver, Colo.

Dr. Amos Walker Barber, Surgeon, U. P., D. & G. R'y, Cheyenne, Wyo.

Dr. Frederick D. Barker, Surgeon, C., H. & D. R'y, Dayton, Ohio.

Dr. G. E. Benninghoff, Surgeon, W. N. Y. & P. R'y, Bradford, Pa.

Dr. A. D. Bevan, formerly Chief Surgeon, Iowa Central R'y, Chicago, Ill.

Dr. Wm. T. Bishop, Medical Examiner, Pennsylvania R'y, Harrisburg, Pa.

Dr. W. R. Blakeslee, Surgeon, N. Y., L. E. & W. R'y, Forest City, Pa.

Dr. A. P. Brumbaugh, Surgeon, Pennsylvania R'y, Huntingdon, Pa.

Dr. D. C. Bryant, Oculist, U. P. R'y, Omaha, Neb.

Dr. W. L. Buechner, Surgeon, N. Y., L. E. & W. R'y, Youngstown, Ohio.

Dr. W. H. Buechner, Surgeon, Erie R'y, Youngstown, Ohio.

Dr. W. M. Bullard, Assistant Surgeon, Montana Central R'y, Helena, Mont.

Dr. James Burry, Chief Surgeon, S. L. S. & E. R'y, Chicago, Ill.

Dr. F. H. Caldwell, Chief Surgeon, S. F. & W. R'y, Waycross, Ga.

Dr. E. C. Carr, Surgeon, P. C. C. & St. L. R'y, Coshocton, Ohio.

Dr. M. Cavana, Surgeon, N. Y., P. & O. R'y, Oneida, N. Y.

Dr. Henry W. Coe, Surgeon, East Side R'y, Portland, Ore.

Dr. D. H. Coover, Surgeon, U. P. R'y, Denver, Colo.

Dr. C. K. Cole, Chief Surgeon, Montana Central R'y, Helena, Mont.

Dr. George W. Crile, Surgeon, C. C. C. & St. L. R'y, Cleveland, Ohio.

Dr. Geo. Chaffee, Surgeon, L. I. R'y, Brooklyn, N. Y.

Dr. G. P. Conn, Chief Surgeon, C. & M. R'y, Concord, N. H.

Dr. R. H. Cowan, Surgeon, N. & W. R'y, Radford, Va.

Dr. Wm. T. Dalby, Assistant Surgeon, U. P. R'y, Salt Lake City, Utah.

Dr. C. M. Daniels, Chief Surgeon, Erie R'y, Buffalo, N. Y.

Dr. W. O. Daniels, Principal Surgeon, Georgia Penitentiary, Atlanta, Ga.

Dr. J. I. Darby, Chief Surgeon, G. & A. R'y, Americus, Ga.

Dr. J. G. Davis, Chief Surgeon, L. N. A. & C. R'y, Chicago, Ill.

Dr. LeRoy Dibble, Surgeon, C., R. I. & P. R'y, Kansas City, Mo.

Dr. N. F. Donaldson, Assistant Surgeon, U. P. R'y, North Platte, Neb.

Dr. Edward M. Dooley, Surgeon, N. Y., L. E. & W. R'y, Buffalo, N. Y.

Dr. J. B. Eagleson, Division Surgeon, Great Northern R'y, Seattle, Wash.

Dr. F. B. Eaton, formerly Oculist Ore. R'y & Nav. Co., Portland, Ore., now at San Jose, Cal.

Dr. William H. Elliott, Chief Surgeon, Georgia Central R'y, Savannah, Ga.

Dr. W. L. Estes, Chief Surgeon, L. V. R'y, S. Bethlehem, Pa.

Dr. C. D. Evans, Surgeon, U. P. & B. & M. R'y, Columbus, Neb.

Dr. A. E. Evans, Surgeon, B. & O. R'y, Columbus, Ohio.
Dr. D. S. Fairchild, Surgeon, C. & N. W. R'y, Clinton, Iowa.
Dr. Spencer M. Free, Surgeon, B. R. & P. R.R., Du Bois, Pa.
Dr. Chas. B. Fry, Surgeon, Big Four R'y, Matoon, Ill.
Dr. L. C. Ford, Assistant Surgeon, U. P. R'y, Lima, Mont.
Dr. J. H. Ford, Chief Surgeon, Big Four R'y, Wabash, Ind.
Dr. John F. Fulton, Surgeon, N. P. R'y, St. Paul, Minn.
Dr. W. J. Galbraith, Chief Surgeon, U. P. R'y, Omaha, Neb.
Dr. M. Gardner, Chief Surgeon, Southern Pacific R'y, San Francisco, Cal.
Dr. David Gildner, Surgeon, B. & O. R'y, Rockwood, Pa.
Dr. R. P. R. Gordon, Surgeon, G. F. & C. R'y, Great Falls, Mont.
Dr. W. W. Grant, Surgeon, C. R. I. & P. R'y, Denver, Colo.
Dr. E. Griswold, Surgeon, Erie R'y, Sharon, Pa.
Dr. J. D. Griffith, Consulting Surgeon, K. C., F. S. & M. R'y, Kansas City, Mo.
Dr. Henry Hatch, Surgeon, C., B. & Q. R'y, Quincy, Ill.
Dr. Jesse Hawes, Division Surgeon, U. P., D. & G. R'y, Greely, Colo.
Dr. R. S. Harnden, Surgeon, Erie R'y, Waverly, N.Y.
Dr. R. L. Harris, Chief Surgeon, S. & St. A. R'y, Oakland, Fla.
Dr. Geo. W. Harrison, Surgeon, C. & N. W. R'y, Ashland, Wis.
Dr. Fred J. Hodges, Chief Surgeon, C. & S. E. R'y, Anderson Ind.
Dr. G. W. Hogeboom, formerly Chief Surgeon, A., T. & S. F. R'y, Topeka, Kan.
Dr. R. P. Izlar, Surgeon, Plant System of R'ys, Ocala, Fla.
Dr. Milton Jay, Chief Surgeon, C. & E. I. R'y, Chicago, Ill.
Dr. Webb J. Kelly, Surgeon, Big Four R'y, Galion, Ohio.
Dr. Samuel Kennedy, Surgeon, Big Four R'y, Shelbyville, Ind.
Dr. T. C. Kennedy, Surgeon, Big Four R'y, Shelbyville, Ind.
Dr. C. B. Kibler, Surgeon, N. Y., P. & O. R'y, Corry, Pa.
Dr. J. P. Kirkpatrick, Surgeon, P. C. C. & St. L. R'y, London, Ohio.
Dr. Lester Keller, Surgeon, C. & O. R'y, Ironton, Ohio.
Dr. N. Y. Leet, Chief Surgeon, D., L. & W. R'y, Scranton, Pa.
Dr. Sherman Leech, Surgeon, B. & O. R'y, Mt. Sterling, Ohio.
Dr. L. E. Lemen, Division Surgeon, U. P. R'y, Denver, Colo.

Dr. C. B. Lyman, Assistant Division Surgeon, U. P. System, Denver, Colo.
Dr. K. A. J. Mackinzie, Chief Surgeon, Ore. R'y & Nav. Co., Portland, Ore.
Dr. Wm. Mackie, Surgeon, C., M. & St. P. R'y, Milwaukee. Wis.
Dr. H. J. Maynard, Division Surgeon, U. P., D. & G. R'y, Cheyenne, Wyo.
Dr. W. J. Mayo, Surgeon, C. & N. W. R'y, Rochester, Minn.
Dr. S. L. McCurdy, Surgeon, Penna. Cent. R'y, Pittsburg, Pa.
*Dr. E. A. McGannon, Surgeon, Grand Trunk R'y, Brockville, Can.
Dr. Henry McHatton, Surgeon, Southern R'y Co., Macon, Ga.
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